

Beyond specialization: Generalization and harmony as academic ideals in the Netherlands around 1900

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ABSTRACT

A standard account of how the sciences developed around 1900 tends to identify *specialization* and an increasingly strong *pragmatic orientation* as the driving forces shaping the sciences in this period. We want to oppose this account: Focussing on a number of inaugural lectures delivered at Dutch universities around 1900, we emphasize the prominence of *integrative* ideals, and the equally notable absence of references to specialization. The notion of *unity* upon which these ideals are based is extremely rich: the unity of a person, unity of education and research and unity within the system of the sciences all are aimed at simultaneously. Remarkably, this attitude is not a reactionary one, but is intimately related precisely to the emergence of new disciplines.

The main goal of this paper is to establish the presence and the relevance, across the disciplines, of these integrative ideals. This leads to a number of important questions that need to be asked with respect to the dynamics of science in this period: how can the relevant notions of unity and harmony be conceptualized? and – a question not to be pursued here – how, then, did the ideal of specialization become as dominant as it appears to be today?

Keywords: discipline formation; specialization; harmony

'Take off your shoes: you are on Holy ground.'

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¹ H. Brugmans, *Het belang der economische geschiedenis. Rede, uitgesproken bij de aanvaarding van het hoogleraarsambt in de geschiedenis aan de Universiteit van Amsterdam* (Amsterdam 1904) 43: 'Ontshoei Uwe voeten: gij staat op gewijden bodem'. This refers to Exodus 3–5 and thus to the promise that, under Moses' guidance, the people of Israel will get to the promised land.

Introduction: Generalization in the dynamics of discipline formation

When academics position themselves within the academic landscape, a characteristic pattern is recurring again and again. In the genre of texts aiming at defining a scientist's relationship with her own discipline and with the academic field at large, we find, on the one hand, a clear incentive to contribute to innovation, not only on the level of results, but also on the larger-scale level of the disciplinary structure of the field. This implies the necessity to state the *differences* of one's own approach as compared to that of others. On the other hand, there is a strong urge to be part of this very landscape, and this rather leads to an emphasis of the points of *contact* with other disciplines.² This simple observation already renders doubtful the idea that the main dynamics driving academic science can be located in the increasing *differentiation* or *specialization* of disciplines. New ideas in the academic world, but also larger-scale entities such as disciplines intend to distinguish themselves from the existing ones; but they also seek to establish contact with the disciplinary structures that already exist.

If one considers the universities in particular, integrative moments played an important role in establishing the idea of the modern university. The classical university programmes, as formulated around 1800 by Wilhelm von Humboldt and others, place great emphasis on unity, on all levels, and capture this integrative spirit in concepts such as *Bildung* that are directed towards forming human beings in their holistic complexity.³ Does this imply that science and the university later take a turn towards the pragmatic, towards a clearly practice-driven attitude in which the applicability of science occupies a crucial role? Does specialization become the driving force behind scientific and academic progress? Do we see a clear turn towards research as taking precedence over education within the universities? In the literature, it is frequently stated that around 1900, at its latest, these transitions have indeed been made.⁴ Here are some exemplary illustrations. Sociologist of knowledge Rudolf Stichweh takes the step towards specialization as being the very definiens of what it means to be a scientific discipline:

2 For an enormous project dedicated to this task, see the eight volumes collecting the contributions of the 1904-St. Louis conference on the arts and sciences: H.J. Rogers (ed.), *Congress of Arts and Science. Universal Exposition, St. Louis, 1904* (Boston/New York 1905–1907). On this project and related discussions see P. Ziche, “Wissen” und “hohe Gedanken”. Allgemeinheit und die Metareflexion des Wissenschaftssystems im 19. Jahrhundert, in: M. Hagner e.a. (ed.), *Der Hochsitz des Wissens. Das Allgemeine als wissenschaftlicher Wert* (Zürich/Berlin 2006) 129–150.

3 For a summary, see R. vom Bruch, ‘Langsamer Abschied von Humboldt? Etappen deutscher Universitätsgeschichte 1810–1945’, in: M.G. Ash (ed.), *Mythos Humboldt. Vergangenheit und Zukunft der deutschen Universitäten* (Wien/Köln/Weimar 1999) 29–57, here 34–37. Vom Bruch identifies four strands in Humboldt's arguments: liberal ideas leading towards distancing the university from state activities; transforming the traditional *universitas litterarum* into a philosophically founded idea of the unity of the sciences; a novel concept of *Bildung* that is directed towards, and rooted in, a new self-understanding of the *Bürger*; science becoming a research directed, and no longer encyclopedia-based activity.

4 L.J. Dorsman e.a. (ed.), *Universitaire vormingsidealen. De Nederlandse universiteiten sedert 1876* (Hilversum 2006)

7. For further illustrations see, for instance, Vom Bruch, ‘Langsamer Abschied’ (n. 3) 34; the ‘classical’ German university is summarized here under two core ideas: universities become more research oriented, by adopting an ideal of teaching that requires teaching to be based upon research; and the emergence of a system of ‘Fachwissenschaften’ where each has its own disciplinary matrix. For the field of history, see for instance L. Raphael, ‘Die “Neue Geschichte” – Umbrüche und Neue Wege der Geschichtsschreibung in internationaler Perspektive (1880–1940)’, in: W. Küttler e.a. (ed.), *Geschichtsdiskurs. vol. 4: Krisenbewußtsein, Katastrophenerfahrungen und Innovationen 1880–1945* (Frankfurt a.M. 1997) 51–89, here 53 on the ‘Eigendynamik des arbeitsteiligen Wissenschaftsmodells’ that is seen as having become the international standard in the course of the 19th century, and a ‘Trend hin zur Spezialisierung und zur kommunikativen Abschließung des fachhistorischen Erörterungszusammenhangs’.

It [the scientific discipline] transforms from being an order of established knowledge for teaching purposes into a social system of specialized research and communication.⁵

For the Dutch university system, Leen Dorsman summarizes the developments after the 'Wet op het hooger onderwijs' (Law for higher education) from 1876 as a transformation from a mainly teaching-directed and generalist institution towards an institution devoted to specialist research:

Thereby also the role of the university changed, from a teaching institution into a centre for scientific research. The professor was no longer a moral leader and a guide for how to live, but he had become a scientific specialist.⁶

While this is certainly in agreement with the widely felt, and widely lamented, trends towards increasing fragmentation of all aspects of culture and life around 1900, it needs also to be emphasized that the academic practitioners relate to these cultural determinants in complex ways. Not all cases of discipline genesis conform to this pattern. It has been shown, for instance for the genesis of national philologies and for the philosophy of mathematics around 1900, that generalization can indeed play a crucial role within processes of discipline formation.⁷ Another argument against the prominence of specialization can be derived from the fact that the sciences (in the broad sense of the Dutch 'wetenschappen', or the German 'Wissenschaften') in this period reach out to become ever more influential on the broader market of world views, and become a cultural determinant at large. The academic speeches analysed here add an important facet to these trends: In reflecting on science (in the broad sense) from within the academic institutions and thus from within a context that is strongly determined by trends towards specialization, we frequently find a rhetoric of unification. Our analyses show this to be more than just rhetoric: We find an anti-specialization discourse not only in philosophical meta-reflection or in compensatory counterarguments against the negative implications of specialization, but also as an internal feature of disciplinary self-reflection both in traditional and, importantly, also in innovative fields. David Baneke has reconstructed the 'trend toward synthesis' in Dutch science in this period. What distinguishes his study from the approach we take is that he relates this trend clearly to the creation of 'all-encompassing philosophical systems'.⁸ What we intend to show is that even *within* the sciences themselves, and at the core of processes that might also be described as processes towards increasing specialization, the trend towards increasing generality plays a key role (Cf. fig. 1 to illustrate the relationship between religion/rituals and science).

5 'Diese wird aus einer Ordnung gesicherten Wissens für Zwecke der Lehre zu einem Sozialsystem spezialisierter wissenschaftlicher Forschung und Kommunikation'. R. Stichweh, *Wissenschaft, Universität, Professionen. Soziologische Analysen* (Frankfurt a. M. 1994) 279.

6 'Daarmee veranderde de rol van de universiteit van een onderwijsinstelling in die van een centrum voor wetenschappelijk onderzoek. De professor was niet langer een morele leidsman en een leraar voor het leven, hij was een wetenschappelijke specialist geworden'. Dorsman e.a., *Universitaire vormingsidealen* (n. 4) 7.

7 G.J. Johannes, "'Nationale filologieën" en het historisch onderzoek naar disciplinevorming in de geesteswetenschappen. Een verkenning', *Studium* 1 (2011) 31–46; P. Ziche, 'Generalization and the Impossible: Issues in the search for generalized mathematics around 1900', in: G. Link (ed.), *Formalism and Beyond. On the Nature of Mathematical Reasoning* (Boston/Berlin 2014) 209–227.

8 D. Baneke, *Synthetisch denken. Natuurwetenschappers over hun rol in een moderne maatschappij, 1900–1940* (Hilversum 2008) 134. Baneke also presents a much broader study of Dutch inaugural lectures in this period, and also on their broader context within Dutch cultural history.



Fig. 1: 'Religion de l'humanité': The 'Temple of humanity' in Paris, conceived on the basis of Auguste Comte's positivist ideas on science's underlying all aspects of human life. Since 1903, this 'temple' is owned by the Brazilian 'positivist church'. It illustrates – together with the numerous positivist temples in Brasil – the close connection, running both ways, between scientism and religion around 1900. (Photography: P. Ziche)

How far can one go in interpreting quotes such as the motto stated at the beginning – taken from an inaugural lecture in history from 1904 – with its biblical language and high-flung ideals? The characteristic integrative attitude can be analysed in a number of ways: As a typical feature of this peculiar genre, the academic speech, which directly forces the orator to position himself as an innovator within a traditional institution, belonging to which is a matter of personal pride; it might reflect a deeply engrained difference between teaching – in which a *Bildungs*-tradition may continue to remain prominent – and research which might follow a different dynamics that is more geared towards specialization; or, more affirmatively, it could be read as subscribing to a way of thinking about science that intends to highlight precisely this aspect of generality.

In this paper we want to exploit this type of sources – programmatic speeches reflecting upon the role of both new and traditional disciplines within the universities around 1900, based upon a selection of texts from Dutch universities.⁹ This in order (1) to establish clearly that differentiation was *not* standardly presented as being the motivational force behind a new professor's defining his place within academia, but that it were precisely arguments for integration and unity that were given prominence in these discussions of the academic landscape in this period, and (2) working out some of the more conceptual issues that were used to support this integrative attitude. It also needs to be asked how these overarching

⁹ For an overview over and for a discussion of the relevant legislation see P. Baggen, *Vorming door wetenschap. Universitair onderwijs in Nederland 1815–1960* (Delft 1998).

concepts governing reflective thinking about the academic world affect the relationship between education and research as the key tasks of the university: can one really observe, as one might expect within a framework determined by specialization, an increase in the importance of research at the expense of education?¹⁰

A comment on the sources that we use is important. Clearly, as has already been stated, this genre of texts carries its own problems. However, these texts have an important role to play in academic life. They are attuned to the expectations and the shared ideals of the community; even if they do not reflect academic practice completely, even if they are – and also precisely because they are – rhetorically polished statements, they at least offer insight into what was taken as being an ideal and widely shared conception of academia. That means that issues of representativity become of subordinate importance here. Because our goal is to establish an alternative reading of the dynamics of discipline formation and of the reflection on these formative processes that goes against established research opinions, it is sufficient for us that the ideas we derive from the texts are shared by a number of authors across academic disciplines and across several universities. A similar point needs to be made with respect to our focus on Dutch sources. Our concern is with highlighting concepts and arguments that are shared, in surprising unison, throughout a broad variety of disciplines; we do not claim that academic processes in the Netherlands are distinctively different from those in other regions. One distinctive feature, however, has already been named: While the legislation from 1876 strongly emphasized a more specialist and research-driven turn, the academic lectures keep up an integrative attitude nonetheless.

Generalization vs. specialization – Integrative programmes in inaugural lectures

Inaugural lectures naturally tend to combine conservative aspects – after all, the new field has to fit into the university – with innovation. In a surprisingly large number of cases, this balance is brought about by a focus on *generality* and *integration*. Hajo Brugmans (1868–1939),¹¹ the Amsterdam historian with the biblical call to devotion that has been quoted as a motto, enters his chair at the university of Amsterdam in 1904 with an inaugural lecture that discusses the importance of economic history as a recent addition to the disciplinary field of history. In the opening paragraphs of his lecture, he places himself within a tradition of Amsterdam historians, referring back to Vossius and Barlaeus. At the same time, he strongly emphasizes profound changes in the way how we should conceive of the usefulness of history. No longer is it the task of history to teach ‘us sage and practically relevant lessons’,¹² and he refers to the forming of ‘pious Christians and wise citizens’ as something from the past.¹³ However, this change does not lead him towards embracing a more pragmatic attitude; the opposite is the case: What is asked for today is not pragmatics, but fundamental reflection.

10 For a brief comment on this ‘paradoxical’ combination of a directedness towards the individual with attention to the collective, see J. Tollebeek, *De toga van Fruin. Denken over geschiedenis in Nederland sinds 1860* (Amsterdam 2007; online: http://www.dbnl.org/tekst/tollo11toga01_01/) 180.

11 On Brugmans, see *Ibidem* 133, 138–158, on his inaugural lecture 142. Integration is here described as a character trait of Brugmans (‘verzoenende gemoedelijkheid’, 157). – Relevant for our context are also his discussions on teaching structures, for instance on the question whether historians should be examined via a ‘Staatsexamen’.

12 Brugmans, *Belang* (n. 1) 1–2: ‘Al denken wij ook even hoog van onze wetenschap als hij, het nut van haar beoefening zoeken wij thans niet meer in de wijze, practische lessen, die men op ieder gebied uit de geschiedenis kan trekken.’

13 *Ibidem* 2: ‘Vrome Christenen dus en wijze staatslieden had de geschiedenis te vormen.’

The usefulness of his discipline has to be conceived of in the broadest possible sense, and has to reach beyond the merely practical. Practical usefulness seems outdated at the turn towards the 20th century: 'One now appreciates the usefulness of general considerations concerning the foundations of our discipline. Principle becomes opposed to principle. The age-old question 'what is history?' that has not yet been answered, and can never be answered in a satisfactory way, becomes posed again and is decided upon in different ways.'¹⁴

What is required, then, are fundamental considerations addressing the very definition and essence of the various disciplines, and leading to 'theoretical' and 'philosophical considerations' that can, via their role in deductive arguments, 'go further than induction may reach.'¹⁵ This is frequently discussed in a rhetoric adopting the terminology of 'higher' ideas. Brugmans, for instance, claims a 'higher standpoint'¹⁶ that discusses the philosophical foundations of each scientific discipline. Without this overarching perspective, the scientific practice will get dry and stale in its pragmatic soberness. This climbing up towards ever higher philosophical standpoints is subject to an important methodological restriction in that the historian must never lose contact with the facts. The historian's 'most important duty', however, does not coincide with this search for an experiential basis. What the historian ultimately and most importantly has to aim at is, rather, a form of 'higher unity'.¹⁷

Brugmans uses a concept such as 'duty' that explicitly carries moral connotations. Which concepts can support this moral commitment to a search for unity? While the main body of Brugmans' speech focuses on examples and case studies and does not pursue a more conceptual argument, he returns towards this issue at the end by making two pertinent points. The first concerns the mutual relationship between the various sub-fields of history. None of them excels above the other: 'No historical discipline deserves priority',¹⁸ they all form part of a larger whole. The unity of the subject-matter of history, 'the unbreakable bond of several historical facts',¹⁹ needs to be reflected in an equally unified understanding of the discipline of history. Given this unity among the historical facts, and given man's 'inclination towards unity',²⁰ history necessarily is universal history. If all sub-fields of history form a unity, it follows that all are of equal value, and no historian needs to feel herself threatened by a new field such as economic history. This is a highly characteristic argument that returns again and again in the scientific debates around 1900: Various disciplines and, frequently, even various types of sciences on a larger scale, become juxtaposed without the need to introduce strong hierarchies. Rudolf Stichweh analyses the genesis of disciplines in general – and this applies in particular to the emergence of new disciplines in the 19th

14 Ibidem 6: 'Men ziet het nut van principieele gedachtenwisseling over de fundamente van onze wetenschap in. Beginsel wordt tegenover beginsel gesteld. De oude twistvraag: Wat is geschiedenis?, nog nimmer beantwoord en ook nooit bevestigend te beantwoorden, wordt wederom gesteld en naar uiteenlopend inzicht beslist.'

15 Ibidem 6–7: 'Theoretische beschouwingen hebben steeds groote waarde. Zij geven vaak deductief een verklaring van verschijnselen, waartoe men inductief wellicht nooit zou zijn gekomen. Ook kan geen vak van wetenschap op den duur den filosofischen grondslag missen, wil het geen gevaar lopen aan al te grote nuchterheid te verdrogen.'

16 Ibidem 7: 'Om een ruimen blik over het geheel te verkrijgen, moet men in de hoogte een standplaats kiezen.'

17 Ibidem 10: 'hij moet de hoogere eenheid zoeken in de aan de oppervlakte liggende schijnbare veelsoortigheid.'

18 Ibidem 35: 'Geen enkele van de historische wetenschappen heeft recht op den voorrang.'

19 Ibidem 9: 'Maar ik constateer ook, dat daardoor tevens een eenheid is verbroken, die niettemin bestaat; die te vinden is een der voornaamste plichten van den geschiedschrijver' and 34: 'de onverbrekelijke eenheid tusschen de verschillende historische verschijnselen.'

20 Ibidem 34. – See also Brugmans' popular publications on 'universal history', in particular the series by H. Brugmans & G.W. Kernkamp (eds.), *Algemeene Geschiedenis* (Leiden 1902–1908).

century – in precisely these terms as a matter of *horizontal* differentiation that results in a far-reaching ‘destratification.’²¹

What is minimally needed in this situation, is at least one concept that can support the general unity within which juxtaposition can take place. In Brugmans’ case, he adopts a twofold strategy to address this issue. One aspect has already been mentioned: historical phenomena themselves are integrated in a complex fashion, and therefore also need to be studied in a way that answers to this integratedness. In this sense, every historical phenomenon can be called universal, and we can thus rely upon a completely natural notion of ‘universal history’ in order to support the coexistence of various forms of historical research. His second strategy highlights a concept that is related to the notion of science in its most general form, but that at the same time has a strong basis in academic teaching and that builds forth upon the idea that doing science is a duty: the concept of a ‘scientific ethos.’²² Although formulated in moral terms, ‘ethos’ (in Dutch: ‘tucht’, which might also be translated as ‘discipline’ in the sense of keeping tight control on scientific practice) refers in the first line to general methodological issues that are immediately transformed into strong claims as to the task of academic education. Teaching at the universities is not and should not be concerned with the ‘positive knowledge of facts’;²³ rather, phrased in typically humanities’ terms, the students need to develop a proper ‘understanding’, a ‘historical sensibility’, they have to ‘sharpen their historical gaze’ and to ‘evaluate the proper meaning of facts and states.’²⁴ On this basis, the various notions of unity that Brugmans employs begin to coincide: Unity in the phenomena of history and in the inner organization of the discipline of history; unity as the goal of a comprehensive education of the student and scientist, opposed to just accumulating knowledge. In this conceptual framework, the role of pragmatics becomes subordinated when compared to a characterization of the study of history in very broad methodological terms, and the new discipline (or sub-discipline) of economic history is described in terms of a rather *traditional* picture of what education has to strive at – and this picture becomes explicitly presented as contributing to disciplinary innovation.

Let’s look at another discipline that only starts to find its place around 1900: sociology. Sociology is placed in a tension that directly reflects the integration-specialization problem. On the one hand, sociology has to study an enormously broad range of phenomena; on the other hand, it is looking for a distinctive disciplinary identity. This tension is commented upon by some of the classic authors of sociology. One example: Georg Simmel, in his programmatic text on the ‘Gebiet der Soziologie’ from 1917, requires that sociology find a specific basis for studying man; „nothing at all is gained by just lumping together the totality of sciences, and sticking the new label: sociology unto it’.²⁵

21 For an analysis of the genesis of the discipline of physics along these lines, see Stichweh, *Wissenschaft* (n. 5) 18, 291. See also P. Ziche, *Wissenschaftslandschaften um 1900. Philosophie, die Wissenschaften und der nicht-reduktive Szientismus* (Zürich 2008) on horizontal models for ordering the sciences.

22 Brugmans, *Belang* (n. 1) 36: ‘Ook op dit gebied is wetenschappelijke tucht gewenst’.

23 Ibidem 39: ‘Het [referring to higher education, AdV/PZ] beoogt niet het bijbrengen van de noodzakelijke positieve kennis van de historische verschijnselen. Die moet door de student zijn verkregen, voordat de poorten der Universiteit voor hem worden geopend’.

24 Ibidem 40: ‘niet alleen het gebruiken van historisch materiaal heeft de student te leeren, maar ook het ontwikkelen van historische zin, het scherpen van zijn historische blik’, and 41: ‘de student moet leeren de juiste beteekenis van feiten en toestanden te schatten’.

25 G. Simmel, *Schriften zur Soziologie. Eine Auswahl* (Frankfurt a. M. 1983) 38: ‘so ist nicht das geringste dadurch gewonnen, daß man die Gesamtheit der Wissenschaften in einen Topf wirft und diesem das neue Etikett: Soziologie – aufklebt’.

What Simmel here rejects, is by no means a caricature. The founding father of sociology in the Netherlands, Sebald Rudolf Steinmetz (1862–1940),²⁶ discusses sociology in precisely these broadly integrative terms in a lecture he delivered when still being ‘Privaat-docent’ in ethnology at the University of Utrecht in 1895, on the occasion of opening a course of lectures on ethnology (Steinmetz, 1895). In this lecture, Steinmetz sketches the domain of sociology as being virtually infinite. It stands in contact with, and is important for, virtually every other academic field. But why, then, do we need sociology as an independent discipline? What might appear to pose a threat to the status of sociology, is turned into a strength in Steinmetz’ lecture: True enough, some disciplines – economy, religious studies, ‘and so on’, which is a rather remarkable list in itself – also cover sociological issues, and even employ sociological methods. This, however, does not render superfluous a ‘thorough ploughing of the entire field.’²⁷ The discipline of sociology may then directly be called a ‘*general sociology*’ which claims a ‘new standpoint’,²⁸ a new way of grouping the facts which in itself justifies that sociology may be called a new discipline. This new discipline is presented as a new perspective on the unity of the sciences: ‘sociology is the summary of the work done by other subjects’, ‘one may call her a resumé of the results of all human sciences in a certain way and with particular goals.’²⁹ Sociology is, in an analogy from the military world, the general staff that provides the general strategy for the footmen.³⁰

The parallels to Brugmans’ speech are clear. Both argue for an approach that reflects on the sciences and on their methodology in general, and in both cases the organization of the sciences has to and does indeed mirror the complexity of the subject matter of the various disciplines. For both authors, too, general theorizing and practical, fact-directed research need to and can be integrated.³¹ A first conclusion can be drawn that is independent of the special disciplines under consideration: In many fields, it becomes imperative to explicitly acknowledge the complexity of the subject-matter, in order to account for the subject-matter scientifically without an attempt at a reduction of this

26 On Steinmetz – an extremely problematic figure, given his ideas on racial differences – see G. Rooze, *Sebald Rudolf Steinmetz. Verheffer van het Volk* (MA-thesis Utrecht, 2009). See also, from the period itself: *Steinmetz zoodaals zijn leerlingen hem zagen* (s.l., s.d. [Amsterdam, 1932]).

27 S.R. Steinmetz, *Het goed recht van sociologie en ethnologie als universiteitsvakken* (Utrecht 1895) 5: ‘Omdat enkele vakken, oekonomie, godsdienstwetenschap enz., enkele hoekjes van het terrein bewerkten is waarlijk de grondige doorploeging van den geheelen akker nog niet overbodig geworden, evenmin als geographie en physica de weerkunde onnoodig maakten.’

28 *Ibidem* 5–6: ‘Al die speciale wetenschappen hebben ook in hoofdzaak toch meer speciale bedoelingen, enger en anders dan die der algemeene Sociologie, vroeger en anders ontstaan gaan zij veelal van geheel andere gezichtspunten uit; en dat nieuwe standpunt, die nieuwe wijze van de feiten te groeperen zijn alleen reeds voldoende deze nieuwe wetenschap te rechtvaardigen.’

29 *Ibidem* 6: ‘En dan eindelijk: de Sociologie is de samenvatting van het werk door de andere vakken verricht, men zou haar kunnen noemen een resumé van de resultaten van alle geesteswetenschappen op eene bepaalde wijze en met bepaalde doeleinden.’

30 Very similar ideas are voiced in the section on sociology at the St. Louis conference in 1904 (see n. 3): ‘a stage of development has been reached, common to the growth of all sciences, when synthesis is necessary. What is needed now is harmony of all of the apparent conflicts of sociological theory’. Rogers, *Congress* (n. 2) vol. 7, 785.

31 Steinmetz claims that a student has to formulate courageous hypotheses but also has to subject these hypotheses under the control that derives from (practical) facts: ‘De vergelijkende ethnologie zal hem *niet* afleren, koene, duisternis weghouwendes hypothesen te vormen, maar daarbij zal zij hem *aanleeren*, dringend leeren, door schade en schande, die hypothesen altijd, telkens weer te toetsen aan de feiten; de inductieve methode zal hem een spontane geestesbehoefte worden, en daarmee zal hij bereid zijn tot studie der sociologie, waarvoor de ethnologie de onverbeterlijke propaedeusis vormt’. Steinmetz, *Goed recht* (n. 27) 23.

complexity.³² Second: The tasks of generalization and unification do not stand in tension with the creation of new disciplines. The opposite is the case: New disciplines can make this generalization precisely into their own distinctive task. Geert-Jan Johannes' observation on generalization as an important step *within* the genesis of new disciplines – in his case: the national philologies – can thus be extended. This holds not only for the type of cases he studied – academic fields becoming readjusted in the process of becoming disciplines –, but also for the introduction of completely new disciplines. This implies that the more demarcatory tendencies included in, for instance, the opposition between the natural sciences and the humanities in terms of explanatory vs. descriptive disciplines are not guiding for these processes. Again, Steinmetz provides us with an interesting confirmation when he affirmatively presents sociology, while being the sum total of the humanities, as being at the same time an explanatory discipline, and thus goes beyond the natural sciences-humanities divide.³³

We have already encountered a number of concepts and arguments that can support this generalizing attitude: investigating the methodology shared by various sciences; focussing on broad educative ideals that emphasize the unity of persons; being optimistic as regards the possibility to tackle the complexity of the world of phenomena within science. It needs to be emphasized that this integrative attitude goes beyond what has been discussed in the literature on discipline formation under the title of 'hybridization'.³⁴ Hybridization is too restricted to capture the broad ranging generalizations as discussed by Steinmetz, and the generalizations aimed at by Brugmans operate within one disciplinary field, so that again the idea of hybridization does not seem adequate.

Examples can be multiplied. Take a traditional reflective discipline, philosophy. The philosopher Bernard Hendrik Cornelis Karel van der Wijck (1836–1925) discussed the 'origins and limitations of knowledge' in his inaugural lecture at Utrecht in 1890. According to Van der Wijck, integration is what drives progress; progress comes about when 'different fields get closer to each other'.³⁵ Again, it is the complexity of the subject matter at hand, in this case 'the entire mental structure of man',³⁶ that supports this attitude, and again, one needs to combine the empirical and the speculative approach. Van der Wijck identifies a whole range of scientific suggestions for how to find such general concepts in various fields. Philosophico-psychological theories such as Eduard von Hartmann's

32 In Steinmetz' text, the organization of the discipline is related to the complex positioning of the subject within social contexts (Ibidem 6): '*Iedere* maatschappij bestaat uit *vele* en *velerlei* menschen in *velerlei* groepen verenigd, en *ieder* mensch is zelf weer een *zéér* gecompliceerd wezen, met *vele* eigenschappen en tendenties'.

33 Steinmetz, Ibidem 8: 'Hoe ongelooflijk zwaar de taak ook zij, de algemeene Sociologie zal ernaar moeten streven *de geschiedenis te verklaren*, de wetten van opkomst, bloei en ondergang der volken en kulturen aan te wijzen'.

34 The standard example being the hybridization of philosophy and physiology into the new discipline of psychology, as discussed in J. Ben-David/R. Collins, 'Social Factors in the Origins of a New Science: The Case of Psychology', *American Sociological Review* 31 (1966) 451–465.

35 B.H.C.K. van der Wijck, *Oorsprong en grenzen der kennis. Inwijdingsrede bij de aanvaarding van het Hoogleeraarsambt aan de Rijksuniversiteit te Utrecht* (Utrecht 1890) 5: 'Ik zeide zoo even, dat er vooruitgang in het wijsgerige denken is: de partijen, die vroeger aan tegengestelde polen stonden, zijn nader tot elkaar gekomen.' – On Van der Wijck, see also Baneke, *Synthetisch denken* (n. 8) 127–8.

36 Van der Wijck, *Oorsprong* (n. 35) 5: 'Vandaar dat wij, tot verklaring van s'menschen kennis, behalve de gewaardwordingen, welke door het verkeer met de zinnen ontstaan, van meet aan s'menschen geheelen geest, zijn verstand, gevoel en wil, moeten in rekening brengen'.

philosophy of the sub-conscious, overarching theories in the natural sciences such as the conservation of energy or the indestructibility of matter, Wundtian psychology/philosophy all support this type of integration, and are deemed to be directly relevant for the special sciences.³⁷ These suggestions all find their origin in a general law of thought that Van der Wijck – in the tradition of associationist psychology – introduces as the ‘law of connection’.³⁸ In the search for knowledge, this law dominates the interaction between man and world. Van der Wijck is sketching a process that starts with the diversity of phenomena that have to be united in any cognitive act according to this law of connection. A law of connection can be found on several levels that thereby mutually support each other: In the psychology of cognition, in regularities in nature, and in the relationship between various sciences. Just as man and nature can interact, the same holds for general and for more specialized sciences.

In the lectures studied here, the ideals of specialisation and of pragmatic orientation are remarkably absent. While new disciplines emerge and find their institutional place, thereby needing to define their own position within the field of the sciences to other disciplines and while, usefulness remains an important issue, the programmatic statements within the universities do not embrace the trend towards increasing specialization. Rather, they tend to strongly emphasize an *integrative* tendency in the development of science, and they frequently refrain from relating the usefulness of science to pragmatic successes and instead claim a form of ‘higher’ usefulness that comes phrased in integrative terms. It is evident that the integrative attitude also aims at *legitimatory* gestures: No really new legitimization is required when one integrates or summarizes existing fields. Secondly, this gesture allows one to perpetuate important ideals from the past, most notably ideals related to *Bildung* and its conceptual context. These ideals are more than just a tool to legitimize new disciplines; their prominent role in the lectures studied here shows that they are part of the official code of conduct of the academic world.

All lectures studied so far underline the importance of unity in science and oppose pragmatic differentiation. Differentiation, for instance in the creation of new disciplines, has to contribute to the unity of science. New disciplines are not created in terms of specific hybrids that combine a clearly circumscribed set of already existing disciplines, but in terms of ultimate generalization such as ‘science’ or ‘the sum of the humanities’. It is important to emphasize that the arguments in favour of integration and of increasing generality, though employing concepts that stem from traditional cultural ideals, are presented as coming from the sciences themselves. One might raise the suspicion that these results present an artefact stemming from a bias towards the social sciences and humanities. However, this can easily be countered by just looking at an example. Ernst Cohen (1869–1944), professor for chemistry at Amsterdam, discusses the ‘extremes on the field of the general or physical chemistry’ in his inaugural lecture from 1901. In this lecture, he employs a whole array of integrative strategies. The name used for a discipline needs to allow for space for

³⁷ Ibidem 23.

³⁸ Ibidem 20: ‘De wet van ons bewustzijn is verbinding. Indien ons bewustzijn overal naar schakels zoekt, overal de heerschappij van wetten op het spoor wil komen, geen rust heeft, zoolang het vreemd voorwerp niet als exemplaar eener klasse, eene vreemde gebeurtenis niet als noodzakelijke uitkomst van bepaalde omstandigheden begrepen heeft, zoo door samenvatting overal naar eenheid streeft, het is, omdat het zelf eenheid, steeds identische eenheid is.’

adjustment and development³⁹ and therefore ‘general chemistry’ is the preferred label for his field; further subdivision in an ‘anorganic’, an ‘organic’ and a ‘general’ chemistry is rejected as being ‘completely unlogical’;⁴⁰ science must not be esoteric and needs to reach a broad audience; a ‘harmonious cooperation’ between chemists and physicists does already exist and can be developed further;⁴¹ broad-ranging philosophical ideas such as Wilhelm Ostwald’s philosophy of nature are given as a background theory.⁴² The final coda of his lecture nicely grabs a chemical term, ‘continuous *contact effect*’, and turns it explicitly into a term that also functions on the ‘social-chemical’ level.⁴³ The integrative concepts clearly transcend the boundaries between even the most fundamental disciplinary divides.

Education or research? Balancing the key tasks of the university

‘Her [the university’s] teachers are, in the first line, ordinary school teachers. But they are something more. They are investigators aiming at new roads for science.’⁴⁴

Educative ideals surface frequently in the academic programmes studied so far.⁴⁵ Typically, it have been traditional ideals of education, stated in terms of ‘humanity’ or ‘civilization’, that provide the ultimate goals of academic education, and delineate the framework within which the tasks of university education and research need to be adjusted. That both belong together is uncontroversial. The motto to this section, taken from the 1908 inaugural lecture by the chemist Nicolaas Schoorl (1872–1942), states this in an interestingly ambiguous way. The kind of relationship that he states, or forges, between research and teaching is not at all clear. Does ‘in the first line’ mean: to begin with, only to be later superseded by a higher task? Or does it mean: first and foremost? Another reading is also possible: we might not have to think in terms of a hierarchy at all when we assume that all conceptual issues that have been discussed so far have both an educative and a research-directed aspect.

Passages abound in the lectures studied here in which the importance of education is seen in the complete transformation of the student into a civilized person. Van der Wijck’s lecture is an example: ‘by the style of reasoning, by the broad vision, by the inclination to investigate every problem thoroughly, the man can be recognized who has been a citizen of

39 E. Cohen, *Uitersten op het gebied der algemeene of physische chemie. Rede bij de aanvaarding van het ambt van buitengewoon hoogleraar in de chemie aan de Universiteit te Amsterdam* (Amsterdam 1901) 8.

40 Ibidem 13.

41 Ibidem 16, 25.

42 Ibidem 28, 32–3.

43 Ibidem 41. – On Cohen, see E. Cohen, *Na driekwart eeuw. Levensherinneringen*. Ed. by F. Broeyer & L. Dorsman (Utrecht 2013).

44 N. Schoorl, *De Plaats der analytische scheidkunde in onze samenleving. Rede uitgesproken bij de aanvaarding van het ambt van buitengewoon hoogleraar in de Pharmaceutische en Analytische Scheikunde, Microchemie en Toxicologie aan de Universiteit van Amsterdam* (Amsterdam 1908) 29: ‘Hare docenten zijn gewone onderwijzers in de eerste plaats. Maar zij zijn ook iets meer dan dat. Zij zijn onderzoekers naar nieuwe wegen der wetenschap’.

45 For a very illuminating study of how teaching practices and the dynamics of discipline formation interact, see R. Stichweh, ‘Die soziale Rolle des Professors der philosophischen Fakultät. Ein Fall von Professionalisierung?’, in: R. Chr. Schwinges (ed.), *Artisten und Philosophen. Wissenschafts- und Wirkungsgeschichte einer Fakultät vom 13. bis zum 19. Jahrhundert* (Basel 1999) 335–350. Processes of broadening the scope of a professor’s teaching, and of increasing specialization are shown here to blend into one another.

the academy'.⁴⁶ According to Van der Wijck, education has to change the student completely – both with respect to the personality of the student ('personality' conceived here, again, in a very broad sense) and with respect to the training of a professional. What it means to be a citizen of the academic world is again stated in terms of unity: Without acquiring an overview over the total field of interest, no genuine state of civilization can be achieved. Via academic studies, mankind improves itself and works itself onto a higher level. A very clear expression is given to this idea in a Lecture by Jan van der Hoeven (1802–1868, first a practical medical doctor, then professor in zoology, mineralogy and geology in Leiden and strongly influenced by Herder and the ideal of *Bildung*); this passage from 1846 can also illustrate that this type of ideas indeed relates the period around 1900 to earlier decades: 'Among the most cherished ideas held by the true humanist [literally: the true friend of humankind], certainly that of humanity's gradually increasing in civilization and in knowledge – the so-called perfection of the human kind – occupies the first place'.⁴⁷ Van der Hoeven presents us with a narrative of the history of mankind in which society undergoes a gradual progress towards complete civilization. Science is the major source of, and the key condition for, this progress. The civilization that is aimed at here is characterized in terms of a complete integration of mankind in its totality on the one hand, and on the other as an equally complete integration of all our thinking and acting. What we see is, thus, that the ideals of unity operate on at least three levels: First, unity in the complexity of what it makes to be a civilized human person; second, unity in the complexity of the subject matter of the sciences; third, unity in the organization, external and internal, of the sciences. Sufficient evidence has already been given that these types of unity were conceived of as being closely related.

The educative programmes developed in these texts integrate the training of more technical skills with the large-scale ideals of forming complete persons. When Steinmetz states that 'training is indispensable',⁴⁸ this has a more technical ring to it, but when specifying the skills resulting from this training, he directly refers to human capacities in an extremely broad sense: 'attentiveness to every detail', 'the capability to create a broad (theoretical) construction', or 'the capability to criticize sharply'.⁴⁹ These already broadly stated capacities can again be summarized as the core skill of being able 'to estimate the correct meaning of facts and situations'.⁵⁰ Two highly interesting conclusions can be drawn directly. On the one hand, the focus is indeed on skills required for doing research; academic teaching has to 'prepare

46 Van der Wijck, *Oorsprong* (n. 35) 34: 'aan de trant van redeneren, aan de ruimte van gezichtskring, aan de geneigdheid om ieder probleem tot de diepte door te dringen, herkende men de man, die eens academieburger was geweest'.

47 Quoted after B. Theunissen, *Nut en nog eens nut. Wetenschapsbeelden van nederlandse natuuronderzoekers 1800–1900* (Hilversum 2000) 50: 'Onder de meest gekoesterde denkbeelden de ware menschevrienden beslaat voorzeker een eerste plaats dat der trapsgewijze toeneming van het mensdom in ware beschaving en in kennis, de zoogenoemde volmaaktheid van het menschelijk geslacht' (the original quote in a lecture 'Over de voortreffelijkheid van de hedendaagse beoefening der natuurkundige wetenschappen', published in his 'Redevoering en Verhandelingen' from 1846).

48 Steinmetz, *Goed recht* (n. 27) 26: 'training' is onmisbaar'.

49 Ibidem 26–7: 'Door die opvoeding moet de eigenaardige 'tournure d'esprit' van den Socioloog verkregen worden, die mengeling van hoogste objectiviteit, van teerste sympathie en reinsten eerbied voor *alle* levensverschijnselen, van scherpste kritiek en van grooter veelzijdigheid dan in enig ander vak nodig is, van observatie en analyse, van wijd omvattende theoretische constructie en van oplettendheid voor ieder detail van ieder feit'.

50 Brugmans, *Belang* (n. 1) 41: 'de student moet leeren de juiste betekenis van feiten en toestanden te schatten'.

students for a position in the professor's discipline'.⁵¹ If being a scientist is seen as the pinnacle of what a human being can achieve, this also means that this training contributes to forming complete individuals. Even more striking are statements to the effect that it is *not* the task of the university to provide the student with positive knowledge. One of the strongest statements to this effect can be found in Frederik Jan Louis Krämer's (1850–1928) valedictory lecture in which Krämer, himself being a historian, nevertheless declares that 'courses in history have no place in the university'.⁵² Actual knowledge, in the sense of knowledge of facts, is of less importance than broader skills. Brugmans even states that actual knowledge is a pre-condition for entering the university, and the mere increase of the students' knowledge is not the task of the university: 'Higher education has no interest in the teaching of knowledge concerning historical phenomena; the student has to master these before entering the university'.⁵³ Even the discipline itself is explicitly declared to be unimportant; being educated as a scientist is superior to the training in a specific field: 'the discipline itself is a side issue'.⁵⁴

The picture that the authors themselves are constructing is one in which the different ingredients continuously change places: teaching and research, science and the ideal of a complete and integrative personality become, programmatically, inseparably related. In this view, there is no tension between education and research. Also, there is no clear hierarchy, both teaching and research stand in the service of science. Given education's task to shape complete persons, this means that science thereby becomes more than a purely theoretical activity. Scientific research is viewed as being the very highest of human activities; science is the condition of civilization, the means to promote progress towards becoming a civilized person, and at the same time it also functions as the goal of this progress. The task of conveying information about some particular field of academic research is clearly relegated to a subordinate position. More difficult to disentangle are the various positive achievements that academic education has to aim at: Forming a complete and full-rounded individual, including the moral dimension, and including the general skills of a scientist. The basis for this entanglement lies in running parallel the unity of science and the unity of persons.

This structuring of the field of knowledge and of academic education is decidedly *not* a novel idea around 1900. As a prominent earlier example, one might quote Gerardus Johannes Mulder (1802–1880), the leading Dutch physiologist and chemist in the mid 19th century, who states explicitly that 'in a certain way, any practising of ordered knowledge has a civilizing effect',⁵⁵ and vice versa: the method of science is strictly related to what forms a complete person. This implies that the role of being a scientist becomes indistinguishable

51 F.J.L. Krämer, *Hooger Onderwijs in de Historie. Afscheidswoord tot de Studenten in de Letteren [...] bij het neerleggen van het Hoogleeraarsambt aan de Rijksuniversiteit te Utrecht* (Utrecht 1903) 8: 'Wie optreedt als hoogleeraar aan eene hoogeschool, behoort het zich in te prenten dat hij geroepen is zijne studenten voor te bereiden tot en voor te gaan bij de beoefening van zijn vak als wetenschap'. – Krämer held a chair in 'general history, political geography, and national history'.

52 Ibidem 8: 'Cursussen in de Historie behooren naar mijne overtuiging aan de Universiteit niet thuis'.

53 Brugmans, *Belang* (n. 1) 39: 'Het beoogt niet het bijbrengen van de noodzakelijke positieve kennis van de historische verschijnselen. Die moet door den student zijn verkregen, voordat de poorten der Universiteit voor hem worden geopend'.

54 Krämer, *Hooger Onderwijs* (n. 51) 8: 'Wat de Historie betreft, bij haar is aan de Universiteit het vak zelf – hoe paradoxaal het klinken moge – bijzaak, of, sterker nog, dat vak mag geen onderwerp van het onderwijs zijn'.

55 Quoted after Theunissen, *Nut* (n. 47) 92: 'In zekere zin is het beoefenen van alle geordende kennis beschavend, maar wij hebben hier op het oog de vorming, waarvan het bezit onmisbaar geacht wordt voor elken mensch, die den naam van Hooger opgevoed mag dragen'. The original quote is from 1876.

from the personality of the scientist: science and life become one. For Mulder, the study of nature provided the superior way of educating students. It allows for ‘the development of the noble capacities, of which man can feel the hidden germ in himself’ and ‘I claim that she is indispensable for everyone who loves civilization; she contains more sources for the development of the spirit, than all other sciences’.⁵⁶ Mulder changed his opinion as to which kind of science was essential for achieving this goal. While he started from a strong emphasis on the natural sciences, he later broadened his account to also include the humanities: ‘Practicing natural science as such, and practicing medicine in particular, cannot claim to contribute to general civilization.’⁵⁷ Mulder indeed explicitly claimed that the true, the good and the beautiful are the same and, entirely self-assured, challenged his audience to come up with counter-instances: ‘if you know an exception, please inform me, I know none’.⁵⁸ In this perspective, science discovers the supreme harmony in nature which is the harmony of the true, the good and the beautiful and offers the scientist the possibility to get attached to this supreme harmony (Cf. fig. 2 to illustrate the relationship between science and art).

Again, it needs to be stressed that this rhetoric proved long-living indeed. In an inaugural lecture from 1947, bacteriologist Klaas Christiaan Winkler (1908–1994) fears that this claim is no longer maintained. His strong reaction towards those whom he sees as no longer following this ideal, however, clearly indicates that the ideal still is very much alive: ‘Because he [the scientist not adhering to this ideal] leaves his soul and his responsibility, together with his coat, at the coat rack, it would be more fitting if he just solved crossword puzzles’.⁵⁹ The attitude of complete dedication influences also the world view of the researcher, so again Winkler: ‘The man who is driven towards the study of nature by an inner urge, will always connect his work to his world view’.⁶⁰ In this statement, Winkler does not refer to traditional religion but to a vision of coherence among the elements of the world, and especially to the place of science in the world. As we have seen in the motto, Brugmans even connects science, very directly, with the sacred: Science comes to occupy the place of religion, and, consequently, the scientist’s activity can be viewed in religious terms as a form of devotion.

‘Harmony’: Conceptualizing a generalized notion of science

‘The survival of the fittest’ gives us the key to the explanation of the marvellous harmony, of the excellent agreement of means and purpose which is present in the entire creation.⁶¹

56 Quotes Ibidem 89: ‘de ontwikkeling van de edele vermogens, waarvan de mensch de kiem in zich verborgen voelt’; ‘ik beweer dat zij onmisbaar is voor den op beschaving prijs stellende; dat zij in zich zelve meerdere bronnen van ontwikkeling van den geest bezit, dan vele andere takken van menschelijke wetenschap’ (original quote from 1841/2).

57 Theunissen, *Nut* (n. 47) 92: ‘maar de beoefening van de wetenschappen der natuur als zodanig, en vooral ook die der geneeskunde kunnen op den naam van algemeen beschavend geen regt doen gelden’ (original quote from 1876).

58 Ibidem 88: ‘weet gij uitzonderingen, deelt ze mij dan mede; ik ken er geene’ (original quote from 1849).

59 K.C. Winkler, *O Ratio Perturbata. Uitgesproken bij de aanvaarding van het ambt van gewoon Hoogleraar in de faculteit der geneeskunde aan de rijksuniversiteit te Utrecht* (Utrecht 1947) 15: ‘Daar hij zijn ziel en zijn verantwoordelijkheid met zijn jas aan de kapstok hangt ware het hem beter kruiswoordpuzzels op te lossen’.

60 Ibidem 15: ‘Wie uit innerlijke drang tot natuuronderzoek gedreven wordt, plaatst zijn werk steeds in verband met zijn wereldbeschouwing’.

61 Quoted after Theunissen, *Nut* (n. 47) 77: ‘De ‘overleving van de geschikteste’ geeft hier de sleutel tot verklaring van de wonderlijke harmonie, van die voortreffelijke overeenstemming van middel en doel, die in de geheele schepping heerst’. The quote is from Pieter Harting, in an article on ‘Johannes Florentius Martinet’ from 1883.



Fig. 2: Title page of Ernst Haeckel's *Die Natur als Künstlerin* from 1913. Celebrating nature as an artist reveals clearly the indebtedness of Haeckel, the most radical Darwinist in continental Europe, to traditions of 'Bildung', dating back to the classical period of Weimar-Jena philosophy and literature (see also the terms 'Formenschatz' and 'Schöpfung' in the subtitle – Goethean ideas of form and religious dimensions also enter into Haeckel's scientific celebration of nature).

Unity and *generality* are the key concepts in the programmatic texts we have studied so far. The motto to this final section shows that the rhetoric of unification, here captured in the term harmony, pervades even those discourses that might be seen as naturalistic, scientific, as threatening traditional values. At the same time, this notion adds an aesthetic dimension to the way how science and science education are conceptualized. Taken together with the ideas developed in the previous sections, it becomes clear that it is precisely the most fundamental scientific ideas and the most general scientific attitude that become aesthetically valuable. This notion of *harmony*, prominently used in the motto to this chapter, indeed summarizes the integrative attitude studied so far, and it is adopted in several of the texts we considered.⁶²

Let's collect the conceptual tools offered by our authors in their attempt to integrate scientific progress and a comprehensive world-view:

- 'Unity' itself operates on a number of levels that all remain related to a notion of complexity: persons as complex units; the subject matter of the various sciences as inherently complex; the unity of the complex system of the scientific disciplines. On neither level is there any attempt to achieve *reduction* in the sense of being forced to leave out anything that has already been achieved in one of the sub-areas constituting these complex wholes. The opposite is the case: We are asked to develop the tools to handle this complexity in an integrative and non-reductive way. This makes it possible to relate these forms of unity to one another: The complex and unified subject matter of a science offers the ideal basis for forming a complex, yet integrated personality. On

⁶² One example: Van der Wijck, *Oorsprong* (n. 35) 12: 'Stilzwijgend gaat alle onderzoek van een aangenomen samenhang der werkelijkheid uit' and 27: 'Zoo slaagt zij [natural science, AdV/PZ] een harmonisch wereldbeeld te leveren, dat zich met kracht, waaraan niets ontbreekt, als juist opdringt'. – See also Hagner e.a., *Hochsitz* (n. 2) on the notion of 'generality' in science.

the other hand, only a person who devotes her entire, full and rich personality to her task can achieve anything in science. Science itself need and should not be reductively unified; it should rather be just as complex and rich as its subject matter, and as the personalities engaging in the pursuit of science. Clearly, classical ideals of *Bildung* are prominent in this account of the interrelatedness of the sciences and the development of personalities.

- The inherent complexity of science defies any easy attempt of breaking science down into elements. A clear instance of this attitude can be seen in the refusal of our protagonists to cater, in their academic teaching, for a transmission of knowledge. Science is not viewed as an accumulation of knowledge items; rather, science aims at developing an overview over the complex whole of the scientific issues at hand. This, clearly, is a methodological stance strongly influenced by ideals from hermeneutics and from the humanities more generally that are stressed in a number of the texts under discussion.
- This has important implications for the idea of *progress* in science. Clearly, progress is not achieved by just increasing the store of knowledge. Rather, the ideal of progress is itself organic: just as a plant increases in complexity while maintaining its unity on an abstract level of form, scientific and personal unity can dynamically change and transform without losing its identity. There are numerous passages in our texts that support this view by emphasizing the complex and mutual means-purpose relations with respect to teaching and research, personality and science. Again, ideals from the classical period of theories about *Bildung* (such as Kant's analysis of the organism) can be traced in the background of these ideas.⁶³ A particularly clear illustration is the quote in the motto to this section on evolution's supporting a world-view that is in harmony with religious ideas. If we can place trust in a non-reductive and non-accumulative growth of a scientific understanding of the world, this makes it possible to also integrate apparently disparate world-views.

So far, we focussed on the descriptive task of showing the prominence of integrative and generalizing attitudes in the self-fashioning of academic practitioners around 1900. The results clearly require further support in particular by assessing the kind of sample we took. Also, we did not investigate to which extent these ideas became realized in academic practice. What becomes clear already is that specialization and pragmatic orientation are *not* presented as the key factors determining academic practice. It needs to be emphasized that this is by no means an anachronistic fixation on traditional ideals: even the most avantgarde disciplines – Darwinist biology is an example – adopted the discursive practices of a *Bildungs*-account of science and of the university. Integration and generalization can be viewed as key ingredients in scientific progress, and can be motivated by drawing on various directions of argument: arguments concerning education, concerning the dynamics of disciplines, and concerning the underlying lawfulness of nature can support each other mutually, and acquire equal importance. In this sense, harmony is both a

63 As B. van Bommel shows (B. van Bommel, *Classical Humanism and the Challenges of Modernity. Debates on the Classical Education in 19th-century Germany* (Berlin/München/Boston 2015). Continuities in the notion and role of *Bildung* in the German educative system are very strong – this concept indeed provides a link to 'classical' theories, in a sense that is comparable to the broader unificatory notions studied here.

feature of nature and of the scientifically educated human being, but also a second-level property that supports this exchangeability of types of approaches: Harmony becomes its own meta-concept.

The notion of harmony, nevertheless, occupies a precarious position. This becomes immediately clear when we look at the way in which these concepts (and the entire semantic field related to this concept) is suspended between what may appear to be backwards anachronism on the one hand and genuine scientific progress, including a highly optimistic attitude vis-à-vis science and the sciences, on the other. Harmony, unity and integration can be related to key innovations in science. In particular, these notions can grasp the *openness* that is required for allowing for scientific progress. Harmony is not defined in terms of fixed elements or fixed results, but rather in terms of the relationship between the various subdivisions of science (be they disciplines, insights, objects, or actors). Also, it can account for the ideas from traditional physico-theology as they surface, for instance, in the motto to this section. It needs to be emphasized, however, that the ideal of harmony does not directly lead to a harmonious coexistence of various players in the field. Interestingly, it is precisely harmony-related notions that are employed in a rather strongly critical fashion, for instance when Brugmans emphasizes the holistic structure of science: 'Of course these sciences are worth a separate treatment, but their practitioner must never forget, that they are part of a greater whole'.⁶⁴ Any distortion of this order needs to be stopped, and Brugmans puts this, again, in strongly biologicistic terms: 'a bacillus carrier of confusion of our time'.⁶⁵ It is precisely the integrative stance that, when it is dismissed or seen as being dismissed, supports an aggressively critical stance.

The conceptual predicament in which we find the academic self-reflection of the sciences in the sources we studied can be summarized in the double need to both *demarcate* and *integrate* at the same time. Put differently: The authors endeavoured to develop ever more comprehensive stances while at the same time maintaining high standards in agreement with a rather traditional ideal of scientificity. The final twist in the harmony-directed arguments – namely taking the integrative attitude to provide a strong demarcation criterion that operates in the level of forming complete individuals that thereby contribute to the course of science – again shows that the authors we considered here did indeed attempt to address both the discriminatory and the integrative tasks with the same type of argument. This generates novel questions that need to be answered when we want to understand the development of the idea of science in and after this period: Negatively, it becomes clear that specialization is *not* presented as the driving force behind scientific progress. This result is, in the first line, negative, but it forces us – and particularly so when dealing with a highly self-reflective period as that around 1900 – to evaluate to which extent the double strategy of integration and simultaneous demarcation is viable, and it urgently poses the question how it came that specialization, after all, did become the standard paradigm for analysing the structure of science in this period.

64 Brugmans, *Belang* (n. 1) 12: 'Ongetwijfeld zijn deze wetenschappen een afzonderlijke behandeling overwaard, maar haar beoefenaars mogen toch nooit vergeten, dat zij een onderdeel van een groot geheel onderzoeken en dat grote geheel nooit uit het oog mogen verliezen.'

65 Winkler, *Ratio* (n. 59) 15: 'Daar hij slechts bomen en geen bos ziet, daar slechts zijn eigen taal spreekt, is hij een bacillendragers der verwarring in onze tijd'. – See also Anne Harrington on the possibly totalitarian implications of holism (A. Harrington, *Reenchanted science. Holism in German culture from Wilhelm II to Hitler* (Princeton 1996)).