

Academic Life of Alexander Bain: Integration of Ideas towards Modern Psychology¹⁾

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Abstract: A. Bain's academic activities were chronologically reviewed, followed by a discussion of the historical significance of his ideas for the modern psychology. Descriptions were also made concerning the introduction of his works to other countries, particularly to Japan at the dawn of her new age. Finally it was stressed that (1) Bain did much to free psychology from metaphysical speculation and to establish it as a positive observational science; (2) His psychology was tending to become more behavioral (functional), comparative, and physiological; and (3) He reached a standpoint that is medium in many dimensions, what means he was really an integrator.

INTRODUCTION

In the middle of 19th century, when psychology, parting from philosophy, began to walk her own way, Alexander Bain (1818–1904) founded a general experiential psychology that is pertinent to contemporary psychology, introducing the perspective of faculty psychology based on the rationalism in European tradition, while placing himself in the midst of the stream of associationism (British tradition), and also adopting ideas from physiology that was then rapidly developing. His position was unique one in that he sided neither English nor European thoughts of psychology at that time. It might, for one reason, be under the geographically, historically, and culturally peculiar circumstances of Scotland that this integration of thoughts was realized.

The present paper attempts to review Bain's academic activities, on the basis of his autobiography (Bain, 1904), and the influences on the modern psychology of Bain's ideas. He was born in 1818 and died in 1904 in Aberdeen³⁾, Scotland. He was the first career psychologist, active during the latter half of the 19th century, and was the author of the first systematic book of psychology in two volumes [*"The senses and the intellect"* (1855); *"The emotions and the will"* (1859)].

Bain was first working as mechanic, so strong in mathematics as to be able to understand Newton's *Principia*, though only in English translation. One day, at the age of seventeen, it happened in the town that the Rev. John Murray got the impression that Bain must be a precocious youth. Mr. Murray recommended Bain strongly to prepare himself to go to college. He had wanted to study at a college for a better knowledge of Latin in order to read *Principia* in original version. Although both colleges in Aberdeen received him with the greatest kindness, he finally began to study at Marischal rather than King's College, only because the latter is situated in Old Aberdeen and is more distant than the former to walk to from home in new Aberdeen. Bain was physically not strong.

1) Based on the paper presented at the 9th Annual Conference of British Psychological Society, History and Philosophy Section, 1995, held in Aberdeen, Scotland, as the 450th Anniversary of the University of Aberdeen.

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3) In Bain's time, Aberdeen was enjoying its prosperity with the shipbuilding industry. In Japan connection, it is known that Thomas Blake Glover (1838–1911), born at Bridge of Don, Old Aberdeen, used to be a ship broker, and later a successful entrepreneur, in Nagasaki. (McKay, 1993)

Now, I have primarily been working in psychology of learning with animals, and yet I confess it is only recently that I found the first proposal of the principles of instrumental learning to be attributed to Bain, but not Edward L. Thorndike as is commonly believed. Clifford states, “A historically continuous theory of human behavior, and of the changes in behavior, extends from the applied psychology of the nineteenth century Scotsman, Alexander Bain, through that of Ivan Pavlov, Thorndike,..., and B. F. Skinner.” (Clifford, 1984, Preface). As a learning psychologist, I felt I had to revisit Bain for a reevaluation against recent trend in psychology of learning (cognitivism), having reviewed some aspects of his theory. (Habu, 1990, 1992, 2001)

ACADEMIC LIFE

Bain was interested strongly in some lectures, but not in others. In the class in which he is not interested, he used to occupy himself with self-observation, in writing down and analyzing all the thoughts that successively came to him. Beside, he read a lot of books in the library.

I. College (Marischal College) Course and other studies (1836–40)

1. College Course: Greek under Dr. Brown; Dugald Stewart’s biography of Thomas Reid, *etc.*
2. King’s College Library: “Having got, through Prof. Tulloch, the privilege of taking out books from King’s College Library, —which, in consequence of its being the College to receive all books passing through Stationers’ Hall (Office for Book-publishers’ Union, London—noted by the present author), was the better stocked of the two, —I had the means of getting almost any book I fancied.” (Bain, 1904, p. 45)¹⁾ Foster (*Essays*), Thomas Brown (*Lectures on the philosophy of the human mind*), Hartley (*Observations of man*), Dugald Stewart (*Essays*), Francis Bacon, and John Locke were among those books.
3. Habit of self-observation: “I was perpetually striking out new thoughts that for the moment seemed all-important; and the habit of continued self-observation with a view o ascertaining the laws of mental successions was now established for good, and has remained through life.” (p. 49)
4. Bodily condition: “My bodily condition had considerably deteriorated during the year since entering college, ...The chief derangement that overtook me, ..., was indigestion.” (pp. 49–50)
5. Knight’s class of natural philosophy: “Among the important events of the summer, 1839, I must rank Dr. Knight’s gift of a ticket to attend his Botany Class,... The interest aroused was very great—there was the logic of Classification, brought before me for the first time.” (p. 66)
6. Moral Philosophy lectures: “The amount of attention I gave to the Moral Philosophy lectures was simply to watch for anything that struck me, on the chance of remembering the good things, but without taking notes... I had begun the practice of analyzing in writing the succession of my own thoughts, with the views to generalize the laws of Association. I extended the practice to book compositions;...” (p. 75)
7. M. A. Degree examinations: “I had no difficulty with Christian Evidences, neither did I feel the least anxiety as to Mathematics, Natural Philosophy, Moral Philosophy. I was also well up in Greek. The two subjects where I felt shaky,..., were Latin and Natural History... The declaration of the result coupled Alexander Cruickshank (Prof. John Cruickshank’s son) and me as equal as the top.” (pp. 82–83)
8. Attending the Anatomy class: “I gave up two hours a day to the Anatomy class of Dr. Allen Thomson, which was properly a medical class... The entire course made a most valuable groundwork for future studies in Physiology;...” (pp.100–101)

1) Citations from Bain (1904) below in this section will be indicated in terms of page number only.

II. Preparation for an integration (occupied in library work) (1840–44)

During this period, Bain was exclusively occupied in preparing himself for a large-scale composition in mental science. It is also in this time that he was definitely influenced by A. Comte's Positivism as well as by J. S. Mill's *Logic*.

1. Writing for *London and Westminster Reviews*: Articles chiefly on physical subjects—'On the electrotpe and the daguerreotype' (1840); 'The Accurate Investigations of the Properties of Matter' (1841); 'On Toys' (1842), *etc.*

About the second, he writes, "This essay rose above the region of mere exposition to the ambitious attempt of laying down rules of inductive discovery or invention, by the help of a definite procedure. The procedure was divided into four distinct stages or prescriptions—, namely, to express every fact in as definite language or by as definite and true parallels or imagery as it is possible to use; to give separate expression and attention to every part into which a fact can be divided; and to extract from every fact all the conclusions that are necessarily bound up with it. The rules were copiously exemplified in connexion with the atomic constitution of matter, which was regarded as made up of ultimate particles under the balance of the opposing forces of attraction and repulsion". (pp. 102–103)

On the third, he writes, "It was an ambitious attempt to unfold the psychology, not merely of toys, but of many other interests that seemed to be closely associated with them. The centre and the turning-point of the whole treatment was the Law of Similarity, which was for the first time developed on the scale given to it in subsequent psychological compositions." (pp. 113–114)

2. Psychological essays: 'On the Limits of the Human Faculties' (Theological Society, 1841), 'On the Acquisition of a Knowledge of Human Nature' (Theological Society, 1842?).

3. Dr. George Glennie's assistant (1841–) in Moral Philosophy: "As to the sources and the quality of Glennie's lectures, a few indications are sufficient. His basis was mainly the Scotch School, as represented by Reid, Beattie, and the Campbell; although he did not limit his studies to these." (p.121)

4. Correspondence with John Stuart Mill then working with his *Logic* (1842).

5. Comte's *Cours de Philosophie Positive* (1830–1842).

6. Residence in London (1842–), making acquaintances with academics including J.S. Mill and Thomas Carlyle (1795–1881), and making use of Mill's library as well as the Library of British Museum.

7. Revising the manuscript of Mill's *Logic*.

8. Mesmeric Experiment.

9. Membership of the Aberdeen Philosophical Society: Devoting some time to improve the knowledge of French (1842), "the first use made of it being to read Comte's book for myself". (p. 145) / "Compte's classification of the sciences was a wonderful advance upon anything known at the time; the three stages being very suggestive. The interpolation of the meta-physical stage between the theological and the positive, helped to express certain phases in all the sciences, although, doubtless, the vital contrast in the progress of knowledge was the theological and the scientific in its most perfect form." (p.153) / Concerning the paper 'On a new classification of the sciences' (read at the Aberdeen Philosophical Society, 1843), he writes, "It was so far based upon Comte—taking up his hierarchy, but with the insertion of psychology as an integral department." (p. 158) / With regard to the Society, he writes, "...the society allowed itself to be mentioned by Mill to Comte as one of the centres of Positivism. John Duguid Milne (one of members of the Society) had some correspondence with Comte himself, and was the recipient of his official circulars." (p. 157)

10. The review of J.S. Mill's *Logic*, 'A system of logic by John Stuart Mill' (*Westminster Review*).

III. The first systematic books of psychology as a natural science (1844–55)

This period is most important in that Bain devoted most of his time to compositions of that first, large volumes in psychology.

1. *The Senses and the Intellect*: In the summer of 1844, Bain was already busy with “The senses”. He writes, “...my devotion to psychology was at present exclusive. I was working up the Senses by the help of physiology, — in which I found Carpenter’s *Human Physiology* very useful.” (p. 164)

“The paper on the Human Mind so far anticipated the final form given in the volumes on the Senses and the Emotions as to lay out the subject in nearly the same order, and to adopt the same definitions and laws of the chief constituents. A great deal had been thought and written leading up to this point in the course of previous ten years; and for the first time, the subject had been methodically set forth, while, in the course of composition, many of the portions has been freshly elaborated and expounded. The organic sensations were fully although crudely handled, and the muscular sense put forward at the conclusion of the five senses. The tripartite division of Mind was not distinctly enunciated, but only the fourfold division of Sense, Intellect, Emotion, and Will.” (pp. 202–203)

2. Attendance to Prof. Sharpey’s lectures on the brain and the nervous system: Bain seems to have introduced German human physiology (i.e., Johannes Müller, 1833–1840) and physiological psychology (Herman Lotze, 1852) through the medium of Sharpey and Longet. “A few days spent in London were turned to account in attending Professor Sharpey’s lectures in University College, that part of the course referring to the brain and the nervous system. His exposition contained the most advanced views held at the time. In particular, he gave a resume of the nature of the nerve force, introducing some speculation of Faraday on its character, as illustrated by his electrical researches. I did not preserve the exact tenor of the speculation; but it operated upon my mind in the way of suggesting the doctrine of Spontaneity as necessary supplement to the recognized circle of the nervous current from sense to movement. I had not embodied this addition in any previous sketch of either Sense or instinct, but introduced it somehow into the draft that was in my hands at the time.” (p. 218–219) / “On Sharpey’s recommendation, I got in Paris Longet’s *Physiology*, as a help for the *Senses*, and for the physiology part of psychology generally; and upon it I worked, so far as *The Senses and the Intellect* was concerned: in fact, the first edition of the *Senses* took its cue very much from this study. I kept at the composition of the Psychology draft with steady regularity; being engaged, no doubt, upon the *Senses* chiefly.” (p. 227)

3. Meeting with August Comte (1851): “We sat with him, perhaps, for an hour,... I may say again, with regard to Comte, that I never knew or could imagine such a case of the negation of humour.” (pp. 224–225)

4. Continuing the draft: “In London, I went on with my writing, and, before the end of July, left for Scotland... From Blakes (the Manse of Stobo), I went to Aberdeen, where I stayed for some time. In Aberdeen, I first had access to Sir Charles Bell’s *Anatomy of Expression*, and made a thorough study of the work, adopting it into my plan.” (pp. 228–229) / “It was at the end of 1851 that I resolved upon the final draft of the Psychology, which was put in two parts as ultimately arranged... All the days that I had no lecturing, from the beginning of 1852 onwards, I devoted to composition.” (p. 233) / “The recess of the year, 1852, from July to September, was spent in Scotland, and was partly devoted to actual composition; a good deal of the time having been occupied in reading the works of reference, especially Hamilton’s *Reid*, which I went over and over again.” (p. 234) / “By the end of this year (1853) the *Intellect* was nearly finished; there remaining only the concluding chapters on similarity, and the two subsequent Books. These last became the occupation of the greater part of 1854.” (p. 239) / “On returning to London in September (1854), I took steps for getting the *Psychology* volume published... The printing went on in the first months of 1855; and the book was ready for publication in the month of June... My marriage took place

in May, 1855; ..." (p. 242)/ "In Germany, I had made a commencement of the composition of the the *Emotions* in the final form." (p. 245)

IV. The first career psychologist (1855–80)

Because Bain was liberalist, his application for the teaching staff of colleges in Scotland was not easy one at that time.

1. The union of the two Aberdeen Universities (1860) and Bain's appointment to the new Chair of Logic: "This year saw the union of the two Aberdeen Universities,... Being informed by the Privy Council, I was free to make an application for the new Chair of Logic, whose patronage was vested in the Crown. The Home Secretary was then Sir George Cornewall Lewis; and to him I addressed my application, ... No sooner was my application generally known, than a powerful agitation was commenced in favour of my chief rival, Professor McCosh¹⁾ of Belfast. He had the whole support of the Free Church in Scotland, and sympathies of the great number of the Established Church members as well... In the parts of Scotland where McCosh was known, everything was done to support his candidature. On the other hand, I had in Aberdeen some very powerful aids to my application..." (pp. 263–265) (After all, Sir Lewis decided to appoint Bain to the Chair of Logic)

2. University work, preparation of teaching manuals (1860–1870): "I had to provide successive courses on Psychology and Logic. The first was a matter of no great difficulty, as I could lecture from my volume on *The senses and the Intellect*. For the Logic, I was less prepared..." (pp. 271–272)

3. Other psychological compositions: "The principal work of the year 1866 related to the preparation of Mental and Moral Science (coming out in 1868)... I entertained the project of a single compact treatise that would be an abridgment of the two large volumes, and would include, besides, a historical view of the great leading controversies, ... (pp. 281–283) / "In November, 1867, I read a paper at the Society..., the first of the papers prepared in anticipation of the volume on Education as a Science." (p. 287)

V. Second half of university career (1870–1880)

Being in his high time, Bain wrote a variety of books related to psychology as a science. It was one of his greatest works in this period that he founded the long-lasting journal *Mind*.

1. *Mind and Body* (appearing in 1872): "(to the scheme of the *International Scientific Series*) I made the offer of a volume on Mind and Body, for which, by this time, I had a considerable accumulation of materials, and hoped to bring out without much delay. It appeared in 1872." (p. 312)

2. Criticism of Darwin: Bain was critical against, and did not agree with, Darwinism; for the reason that Darwin's doctrine was based on speculative assumptions far beyond our experiences—namely, anti-positivistic. Bain wrote, "Darwin's Expression of the Emotions came out in the Autumn of 1872, and I immediately perused and analyzed it. This was followed by a very full review of the whole which was put into print and appended to the current (third) edition of *the Senses*... The problem herein presented is somewhat complex, consisting of matters that are fairly within our range, and others that are beyond our reach; it being a necessary clearance of our way to separate the one from the other. Darwin has, seemingly, failed to draw the proper line—as I wish to show... While Darwin has applied successfully this form of legitimate research, he has ventured a step farther, and involved himself in speculations that pass beyond our grasp... It is one

1) James McCosh (1811–1894), a pupil of Hamilton, held a chair in Belfast and wrote a book on *The Intuitions of the Mind* (1860), and was in 1866 appointed to the Presidency of the College of New Jersey (later Princeton University). He continued to propagate Scottish doctrines. Among his best pupils was J. Mark Baldwin (1861–1934). (Hearnshaw, 1987)

of those problems of beginnings that we are never likely to solve. What Darwin endeavoured to account for, must be simply assumed; its origin being beyond our power to reach.” (pp. 318–319)

3. Embodiment of the doctrine of Evolution in the revision: “An entirely new chapter (of the *Emotions*, 3rd ed.) is occupied with Evolution, as bearing on the mind. While Spencer had been devoting his energies to the psychological aspects of Evolution, as well as to its more purely biological aspects, I had hitherto refrained from making any reference to it... In the preliminary chapters on the Will, the primitive elements of volition (viz., SPONTANEITY, and the link of FEELING and ACTION) were reproduced with a supplementary note upon the bearing of the doctrine of Evolution on my mode of stating the fundamental postulates. I made a comparison between my own language... and the language of Spencer and Darwin respectively, by way of showing that my wording could not be dispensed with.” (p. 324–325)

4. *Mental Science* (1872): Consists of *Psychology part only of Mental and Moral Science* (1868).

5. Foundation of *Mind*: “The preparation for bringing out *Mind* were carried on through 1875; and it was considered expedient that the actual start of the first number should be January, 1876.” (p. 330) / “At Paris, I called on M. Ribot, who had started the *Revue Philosophique* at the same time as *Mind*.” (p. 334)

6. *Education as a Science* (1879): “In the course of this year, a commencement was made in the preparation of my volume on Education, in the International Scientific Series. The first portion that saw the light was given in the January number of *Mind* for 1877. It was entitled ‘Education as a science’, and corresponded to the introductory chapter of the volume itself.” (p. 335) / “This year (1878) saw the completion of the volume on *Education as a Science*... The work of the summer included an address to the newly-formed Education Society, of which I was chosen President for the year.” (pp. 340–342)

7. End of college career (1880): “The session 1879–1880 concluded my College career.” (p. 344)

8. Rectorship of the University of Aberdeen: “One of my occupation of the summer had been the preparation of Rectorial address. This took the form of University history.... In addition to the historical survey, I made a point of indicating what I thought a sound view of the University ideal, ...” (p. 363–364)

9. Visiting German universities: “At Leipzig, I called on Professor Wundt, and went through his psychophysical laboratory. A young American student, James McKeen Cattell, was very helpful as an interpreter; ... We called at once on Helmholtz... I called upon Ebbinghaus and ...” (pp. 378–379)

THE LEGACY

Bain’s works were decisively influential in directing old philosophical psychology in large steps toward one of objective, experiential sciences.

I. On disciples and direct influences

1. Concept of Instinctive Behaviour: Douglas A. Spalding¹⁾ attended in 1862 Bain’s lecture and “was greatly interested by the lectures, but at the same time puzzled that issues such as instinct had been debated for so long with arguments based on speculation and plausibility and not on empirical evidence.” (Boakes, 1984, p. 14) In 1868 he met Mill and was greatly impressed. “He began to carry out a remarkable series of experiments on the topics Bain had discussed.” (Boakes, 1984, p.14) “Although the results of his studies (Spalding, 1873) were seen as lending support

1) Known as the first to undertake the experiment on sensory deprivation, and as a tutor of very young Bertrand Russell, the late mathematical logician. (Warren, 1921)

to Spencer, Spalding continued to feel a greater general intellectual affinity with Mill and Bain.” (Boakes, 1984, p. 14)

2. Spontaneity of Action: Bain’s theory of growth of voluntary action incorporating spontaneity as one of its premises is unique (Bain, 1855, p.289), though the idea itself is not of his originality—As is suggested by Yatabe (1953), the spontaneity of action had been proposed by Condillac (1754) and by Lotze (1852), the latter of which must have been read by him at least in the secondary material. (Habu, 1990) It (spontaneity) was also described by J. P. Müller (1833) as “an essential prelude to voluntary power”. (Greenway, 1973) Any way, it was J. M. Baldwin (1895, p. 183) who retained its original ontogenetic value in the “circular reaction.” (Greenway, 1973, p. 42)

3. Principles of Association: In the later French associationism, P. M. Mervoyer (1805–ca.1866) is the best proponent of the doctrine. His ‘Étude’ (1864), which is his doctoral thesis, acknowledges the influence of Locke, Hume, Hartley, J. S. Mill, Spencer, and Bain. The general analysis of the work follows Bain. He holds that human knowledge depends altogether upon two great principles: the law of continuity, as objective one, and the law of resemblance, as subjective one.

4. Spencer-Bain Principle: Conwy Lloyd Morgan accepted Bain’s idea of ‘trial and error learning’ as the mechanism of acquisition of voluntary action. (Morgan, 1896, p. 207, 216; Tolman, 1938; Bitterman, 1969; Boakes, 1984, pp. 35–39)

Edward L. Thorndike (1898) is seen, though not explicitly mentioned by himself, to have been stimulated by Morgan who delivered a series of lectures nearby in Boston in 1895, when Thorndike was in his first year as graduate student at Harvard (Postman, 1949; Boakes, 1984, p. 68; Clifford, 1984, p. 142, 350; Habu, 1990)

5. Motor Association: This idea was transformed by Alfred Binet into the motor image. (Greenway, 1973, p. 42)

6. Psychological Importance to Action: As Warren noticed, Bain placed the active side of mind ahead of the intellectual in his opening analysis. “Perhaps the most important feature in his treatment of the elementary facts of psychology is the prominence he accords to motor phenomena,...” (Warren, 1921, pp. 111–112; Yatabe, 1951) The influences in this respect may be immense. Thus, the aim of Greenway’s essay (1973) was to describe Bain’s attempt to outline the psychological importance of action, and its influence in particular on developmental psychologists such as Baldwin and Binet.

II. On translations

Except for Japanese (abridged) translations, references were made to the bibliography in Bain (1904). Those into western languages were made about a decade earlier than into Japanese. It was several years later than the translation into Japanese of Haven’s *Mental philosophy* (1857) (Nishi, 1875–79) that Bain’s *Mental science* (1868) was translated in abridgment by T. Inoue (1882). For the process of introduction of Bain to Japan, see also Inoue (1927, 1973) and Habu (2001).

1. *The senses and the Intellect* (1855):

1868 edition into French: *Les sens et l’intelligence*. By E. Cazelles. Paris, 1873, 1884.

4. *The Emotions and the Will* (1859):

1875 edition into French: *Les émotions et la volonté*. By P. L. le Monnier. Paris, 1884

5. *Mental and Moral Science* (1868):

1884 edition (psychology part) into Japanese: *Bein Shinri zensho* (Bain’s complete book on psychology). By T. Matsushima *et al.*. Tokyo: Fukyû-sha, 1886.

1884 edition into Japanese: *Bein shi shinrigaku* (Mr. Bain’s psychology). By K. Yajima. Tokyo, 1886.

6. *Mind and Body* (1872):

Into French: *L'esprit et le corps*. by W. Battier. Paris, 1874.

German: *Geist und Körper*. by ?. Leipzig, 1874.

Spanish: *Espritu y Cuerpo*. by A. A. Ramirez de Fontecha. Madrid, 1881.

1883 edition into Japanese: *Shinshin sôkan no ri* (Theories of the relation between mind and body). By K. Morimoto *et al.*. Tokyo: Ôkura, 1886.

7. *Mental Science* (1872):

Abridged translation of American edition, 1875, into Japanese: *Bein shi shinri shinsetsu* (Bain's new psychology). by T. Inoue. Tokyo: Dômei-sha, 1882.

Commentary on Inoue's translation: *Bein shi shinri shinsetsu shakugi*. by S. Asou. Tokyo: Dômei-sha, 1883.

At the dawn of new Japan empirical psychology was introduced as forming a part of measures for the encouragement of science and technology in the country. In the preface of the Japanese version of *Mental Science*, Inoue writes, "The electric wire, the steam locomotive, as well as the alarm clock are all based on the science, which is in turn originated in philosophy, the latter being underlain by psychology... In the orient, the ethics is not meager, but the logic (rationalism) has not yet attained its essence, nor has the empiricism gained its methods. We have no figures who could take it over and raise." (Inoue, 1882, Preface)

8. *Moral Science* (1872):

Into Russian: St. Petersburg, 1881.

9. *Education as a Science* (1879):

Into French: *La science de l'éducation*. by ?. Paris, 1879.

German: *Erziehung als Wissenschaft*. by I. Rosenthal. Leipzig, 1879.

Spanish: *La ciencia de la educacion*. by ?. Valencia, 1882.

Italian: *La scienza dell'educazione*. by ?. Milan, 1885.

Japanese in abridgment: *Bain shi kyoiku gaku*. by T. Soeda. Tokyo, 1883-5.

CONCLUSIONS

The implications for the modern psychology of A. Bain's psychology, constructed through integrating different ideas over his whole academic life, might be as follows:

1. Bain did much to free psychology from metaphysical speculation and to establish it as a positive observational science. He laid the foundations of physiological psychology. (Boyle, 1993)
2. Psychology in Bain's hands was tending to become more behavioral (functional), comparative, physiological, as Cardno (1965) rightly said.
3. Bain reached a standpoint that is medium in many dimensions (passive-active, empiricism-rationalism, monism-dualism, sensory association - innate mental processes (Brennan, 1982), what means he was really an integrator.

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