are also consistent with my more extended theoretical statements in *A Rhetoric of Literate Action* and *A Theory of Literate Action* (Bazerman, 2013a, 2013b).

Other theories of writing development might of course point to other kinds of data. Some of these theories might be consistent with the picture presented here, supplementing it, while others might lead to basically different explanatory systems. For example, although at the moment neurological and brain studies are limited in their applicability to writing, they might provide another dimension, as we are able to track how the brain and neurological system respond during writing processes and how brain architecture might constrain and direct writing development, or might itself develop in response to writing experiences, making more enduring structures out of what might otherwise be contingent and fleeting assemblages. It might even turn out that there are neurobiologically determined elements to meaning, meaning making, and sign use that cannot be influenced by experience, but rather shape experience and thus writing development. While it is likely that neuroscience will develop theories that bear on writing in the coming decades it is hard to predict where they will go and whether they might obviate some or all of the ideas that are built into this design of the study. This would suggest that we collect at least some baseline brain and neurological data for the research subjects using current technology, even though they will likely be superseded by new forms of data and data gathering.

Similarly, given that technologies of communication are likely to change rapidly, we might include more data than would be suggested by our existing theories on how flexibly and creatively our subjects respond to new technologies and how creatively they explore the opportunities provided, as well as how new technologies serve to disrupt prior established writing practices and modes of development. Recent studies, for example, of the response to and effect of learning keyboarding without handwriting are the leading edge of much broader technological studies. As technology may also take over more of the functions of production (as spellchecking, keyboarding, and templates have already done) or facilitate processes (such as revision, collaboration, intertextual access and incorporation, and graphic design), different dimensions of the composition process may come to the fore, even to

the point of overtaking features we had previously thought of as central.

While it is easy to see that developments in neuroscience and technology may lead to new issues to explore and perhaps major theoretical reorientations, other developments may lead in other directions, such as our understanding of the role of written communication in social cooperation, division, and attitude formation, or the formation of larger-group knowledge and beliefs. The multiple variables potentially of importance to writing performance and development both contained within the current theoretical perspectives and within possible future ones suggest that a study be as broad-ranging in its data collection as possible in the initial collection and be flexible in expanding or adding dimensions of data as changing theoretical perspectives come to the fore and new technologies allow enhanced data gathering. Of course, as we will explore below, some relevant data would be difficult and resource-intensive to collect, and the data are of different sorts, so collecting them would require multiple methods. Every extension of data would require further resources and difficulties, so ultimately choices and tradeoffs will have to be made. Yet the broader the initial picture is, the more informed the tradeoff decisions and focused choices may be.

Subject Population and Study Maintenance

This study should have multiple cohorts, representing many different life situations. One possibility would be cohorts of closely matched individuals large enough to show interindividual differences among people of similar socioeconomic and linguistic background as well as initial schooling. For this purpose, choosing each cohort from a single neighborhood that feeds into a single school system would be a reasonable strategy. With perhaps ten to twenty in each cohort cluster, the study could explore both how individual and family variables might have an impact, as well as how individual experiences, dispositions, and interests lead in different directions. But then there should be multiple cohorts from rather different circumstances (such as different socioeconomic situations, different linguistic situations, or different educational backgrounds). Further, it would be useful to

have cohorts from different countries with different national languages and educational systems. Immigration would create further challenges in tracking, but would also be an opportunity to study the impact of mobility. While it would be best to have a high degree of coordination of the research and data collection at these many sites, it is also possible that independently formed and maintained projects can provide useful data for comparison. For example, Vaillant (2002, 2012) was able to make comparisons between the privileged subjects of his Harvard Study of Adult Development and a less privileged set of subjects in the Inner-City Cohort of youth who had gotten into legal troubles (Glueck & Glueck, 1950), even though the designs and purposes of the studies were substantially different.

The usual uncertainties of attrition in such a lifetime study would be compounded by a number of factors. Those with most divergent and expansive writing development may be most difficult to keep track of and may be most geographically mobile. The amount of participation required to get the wide-ranging data of multiple sorts that might be deemed important may get tiresome or inconvenient for participants. Further, as participants get older they may become ashamed or anxious about writing or have some other personal reasons for nondisclosure. While personal contact with researchers who come to be known and trusted, as well as the potential benefits of reflective understanding of writing and the sense of specialness that might come from being part of the study, may help maintain participant loyalty to the research over the years, writing at least currently is viewed as so tied to personal worth and socioeconomic position that there may be much self-selection in and out of the study. That self-selection may be based on what participants view as positive outcomes, so the study might lose sight of trajectories that the participants are not proud of.

In addition to all the difficulties of locating, keeping track of, and maintaining engagement of diverse subjects, and of gathering, maintaining, and analyzing the massive and multidimensional data collected, there will also be practical problems of maintaining research teams in multiple locations with continuity and coordination across multiple generations of researchers. Then there are problems of getting enough initial funding to get such

a large project or even a piece of it off the ground and enough commitments going forward to take the risk. Finally, a research strategy that produces research publications from early on, using only partial data, may be important to demonstrate the value of the study and maintain the commitment of the stakeholders.

Age of Initiation

Since emergent writing behaviors may appear very early in the form of the infant observing and interacting with older sibs and parents and engaging in early play with writing implements, surfaces, and electronic devices, it would be useful to identify subjects as early as possible, possibly even within the first year. While such early interactions may not be considered to be distinctive, there may be substantial differences in the amount of literate behavior around the infant subjects, how they attend to it, and what interactive play and imitative behaviors they engage in. These differences may provide beginning links in the various trajectories people develop as writers and how deeply literacy and writing enter into their formation of communicative consciousness and identity. While we have some broad-stroke understanding of how general exposure to reading and literacy in the family facilitates reading and educational achievement, we really have no detailed understanding of individual formations and how earlier experiences are enacted later, particularly with respect to writing. Early exposure may also have impacts that are not directly expressed in school performance, but may influence other domains of writing outside or beyond schooling. Think, for example, of the child who early on enters into a text-messaging world, perhaps facilitated by touch icons or videos prior to mastery of spelling.

While enlisting infants and their families may present special difficulties and may lead to sociocultural biases in the sampling, children by ages three or four entering daycare and prekindergarten settings might be easier to locate. A careful selection of sites may also overcome sampling bias. Starting data collection at that age would reasonably catch most of the early struggle with writing conventions and discovery of the communicative power of writing, but subjects would best be observed from the first day

to establish starting baselines, which should be supplemented by family visits, observations, and caregiver interviews to gain at least some idea of the child's engagement with language, literacy, and writing prior to organized educational settings.

Consistency and Variation of Data Collection

We should also consider the consistency of data across the lifespan. This study suggests something other than the simple repetition of data collection across all subjects and across all years, as you might have in a health study where the same medical indicators are recorded periodically. At least four considerations suggest a more complex and varying set of data.

First there is difference that comes from different regions. Different samples may present different opportunities, constraints, and strategies for data collection. For example, early childhood facilities and arrangements vary across regions and classes. National curricula and national assessments may also structure educational activities differently. Extracurricular opportunities for writing may vary, such as student journalism or youth organizations. Differently available technologies and popular uses may also influence what can be observed and collected. During adult years, structures of economies and careers, including credentialing and the relation of local to international business, may affect the data to be gathered. Different cultures of personal disclosure may also facilitate or inhibit some kinds of inquiry. Further, the research team within each national research culture and funding regime may have special interests that would supplement the collection for that region. But within these and other considerations, insofar as possible, comparable data should be collected from each of the sites and cohorts.

Second is the influence of age. Interviewing the youngest children might look only for responses and behaviors, perhaps combined with observations of engagement in tasks. These might be supplemented with interviews with parents and siblings. Observations would be in home settings or in interaction with the parents. If there are any documents to be collected, they would be brief, and there will be little self-reporting of processes. As

children develop, more information can be gleaned from them directly through self-reports, though interviews would have to take into account the age, reflectiveness, and experience of subjects. School documents, personal writing, and extracurricular productions could start to be collected. However, since these will be guided by school curricula and standards the relevant institutional documents would need to be collected along with perhaps observations of lessons. Only in later adolescence, the college years, and beyond are written self-reports likely to be informative. As subjects' writing reaches out into complex worlds either in advanced education or the workplace, collection of relevant intertexts that help define the writing situation, the issues at stake, and the available knowledge resources might also be increasingly useful. On the other hand, as writers develop into adulthood, greater self-awareness and experience may allow greater depth and accuracy of self-reporting, including of context. The ability to describe and characterize contexts and strategies for different texts may itself be an indicator of development.

Similarly, the timing of collections would need to be sensitive to age. In the earliest years change is rapid and continuing, so some kind of continuous monitoring by parents, caregivers, or teachers, perhaps through journals, would be useful. Certainly data-collection intervals should be measured in units no larger than months. As children advance through schooling, semiannual collection corresponding to terms might be adequate. And for adults, an intermittent sample of every five years supplemented by self-identified unusual writing and major changes in writing demands might be adequate. While it is hard to calibrate in the abstract what the frequency should be to give a sense of redundant saturation, the production of a few days every five years would generate perhaps 0.1 percent of the overall total, which would nonetheless be a massive amount of data.

Third, as writing lives differentiate so must collection practices. An adult whose writing consists of household records, family notes, text-messaging and social media among friends and family, and routinized job tasks, such as filling out order and inventory forms (all of which might be initiated and completed within a few minutes) might only require limited data collec-

tion. On the other hand, someone who has become a prominent blogger, spending several hours every day reading the blogs of others and other informational sources, and composing and responding to the responses of others, all the while spending all his or her free time thinking about potential themes and ideas, would require a much more extensive collection of data. This in turn would be different from a high-level government worker preparing a single report over several months, consulting many resources in collaboration with others and incorporating much field data collected by both the worker and his or her colleagues. While self-reports in interviews or surveys might capture some of the variety and the extensiveness of people's writing at any life stage, more intense and individualized probes would be needed for more complex cases.

Finally, social and technological changes are likely to mean that writing will be carried out in different ways for different situations over the near century of a lifespan longitudinal study. A study over the last century would have needed to be flexible to accommodate the growing role of typing and then word processing, with its ancillary tools of spell- and grammar-checking, along with the ease of cutting and pasting. The increasing access to knowledge culminating in the World Wide Web would have required greater attention to search and its interaction with memory. Wider access to higher education and graduate professional education would have required new kinds of contextual as well as textual collection, as would the expansion of corporate paperwork, government reporting, and other workplace writing, along with the invention of new forms of personal and leisure communication including the most recent social media. Changing technology also brings new tools of research, which will open up new domains of useful data—in the last century from audio and video to eye-tracking, screen-capture, and network analysis. In the coming century, as technology makes possible new sociocommunicative relations, expands the possibilities of texts, changes the kind of work that goes into text production, and provides new research tools, it will be hard to predict all the kinds of data that will be useful to understand the writing trajectories of the possible subjects of this study.

General Categories of Data

Whatever accommodations are made for age, region, individual activity, and historical change, some basic categories of data are worth considering.

Socioeconomic Position and Uses of Writing. Periodic interviews and self-reports can provide a picture of the socioeconomic position and well-being of the writers and how that might affect opportunities and constraints for writing development. These data might also include the oral and written linguistic environment at home and at school or work. Particularly for children, but also possibly adults, this might include data gathered from family, friends, teachers, or coworkers. The data might indicate perceptions about the kinds of actions, powers, and purposes of writing the socioeconomic position affords, as well as the subject's sense of efficacy. These data could be combined with periodic use of standard psychological instruments measuring efficacy, motivation, perceived value of writing activities, resilience, and the like. Regular self-report surveys can also provide an overall picture of current writing activity including the kinds of writing demands made on the subject in school, workplace, and community. Further, these self-reports could be used to identify moments of change or special uses of writing that might be further investigated by interviews or other more in-depth means. Technology may afford more convenient, quick, and regular self-reporting.

Texts. A sample of texts recently completed and being worked on can be used to evaluate current challenges and the nature of writing being done. As the product of writing processes and the actual accomplishments of writers, they could be analyzed from many directions including language, rhetoric, theme, genre, organization, intertext, format, multimedia, information, self-representation, and interaction. The sample should include texts of all sizes and ambitions, from major projects to daily notes and lists. The samples might be collected in conjunction with periodic surveys or interviews, but more

effective might be periodic emails or other communications asking for a list of texts worked on in the previous day or week, plus digital or paper copies. It may also be possible to ask participants to keep a portfolio of their major productions and samples of their more quotidian ones over a fixed period of months around the periodic data collections, or even a full portfolio of all the most extensive productions across the lifetime. Electronic submission (such as a one-click dropbox) could facilitate the process. With technology already available we could even imagine seamless automated collection of everything produced on personal devices and then some form of automated mining to notice patterns and moments of change. This lifetime file could then be available for later recovery of specific documents.

Situations. For each text collected (or a selection thereof) we could also use reports of the situation within which it arose, the regulations and constraints of the situation, the surrounding texts, and the audience, as well as the affordances and opportunities, the writer's role and authority within the situation, the intended goals and activities, and the strategies and genres perceived as appropriate. The time spent on each of these tasks and the total time of each day or week spent on various writing tasks would also give a sense of the extent of writing in the subject's life at this point. Much of this information can be gained by the writer's self-report through a questionnaire accompanying each submission. As the subjects persist in the study over years the standard self-reports should become routine and easier to accomplish. On the other hand, more complex tasks embedded in complex social activity systems within schooling and outside might gain from some ethnographic study and observation—though this should be reserved for only the most interesting of cases as it is costly in time, effort, and finances. Also, as mentioned earlier for younger subjects, starting in family and prekindergarten and extending perhaps to middle school the collection and context would have to be gathered by ethnographic observation and interviews with caregivers.

Success Measures. In analyzing these texts we need to be careful to be descriptive and not evaluative based on school testing criteria. It is, however, worth gathering information on the texts' success for their intended purposes. For school texts that might well include how they were evaluated in the school context, but also looking to other purposes from the student's or teacher's point of view. Outside schooling the natural success criteria are whether the texts are effective for the tasks at hand, whether the authors feel the forms have expressed their desired meanings, and whether the texts have resulted in the desired consequences among relevant audiences. Writer self-perception of text success may be especially important for development of internal criteria, goals, strategies, and efficacy. Given the different natures of different texts we might need different data to measure success in addition to author perceptions. Much of this can be gained by writers' self-reports and some general psychometric instruments, though interviewing might allow the probes to fit the nature of the tasks more precisely. Interviews could also elicit data on perceived challenges and problems to be solved for each task. Additionally, external measures of success might be useful, such as whether the sale was made from the correspondence, the report accepted and incorporated into the town's plan, or how many responses a comment got on social media.

Processes. Some probe of changing processes would also be useful to understand development. Think-alouds of standard tasks, or delayed think-alouds through keystroke or screen-capture replay, can be useful. On the other hand, processes activated by motivated, consequential, authentic tasks may be substantially different from the processes used for assigned experimental tasks. Self-reports of actual current tasks, particularly of the more ambitious sort, explored in interviews, may be even more informative of how processes, strategies, and self-monitoring are developing. Self-reports of work habits and spaces might be useful. Drawings of workspaces and cartoon storyboards of the process of a recent task have turned out to be useful heuristic devices and prompts for interviews. The extensiveness of these process inquiries would

in part depend on how ambitious the current writing world is for each of the participants.

Human Collaborative Interactions. Major aspects of writing development seem to be fostered by learning in interaction with others, including dispositions, relationships, and imitated strategies. Further, since so much writing is produced in collaborative interactions, developing the skills to contribute to effective collaboration is itself part of writing. Yet, even within collaborations, some processes occur primarily within the individual to produce the ideas, wording, or critical perspectives then shared with others. We have little idea of the balance or dynamics of individual and collaborative work in group composition, but it seems evident that some people have learned to make more fundamental and consequential contributions than others and seem to be better at formulating and aligning with group goals, in order to harness personal resources. There may be many other kinds of skills and dispositions for group productions. While observation of experimental tasks with groups might present some data about processes so robust they could survive the decontextualization and loss of authentic motivations of experiments, collaborative processes may well also rely on trust and other relationship variables developed with specific partners. Therefore some form of naturalistic observation of work teams on the job or in schools during both earlier conceptual stages and later text-production and review stages would be useful. Follow-up interviews using text drafts or videotape prompts can then elicit what the subjects were thinking, their strategies of participation, and their evaluations of their own and others' participation. Further, as collaboration is increasingly electronically mediated, the data collecting needs to be cognizant of the varying platforms and tools employed.

Use of Electronic Media and Technologies of Text Production. The now-familiar technological affordances of spelling and grammar assistants are being supplemented by increasingly sophisticated template support, word and phrase completion, and even complete message production including

current data insertion. Further, information search and text borrowing is being integrated into text production. It takes little stretching of the imagination to see more complete cyborgian integration of human beings, technology, and information access, such that what roles and decisions will be left to the human being are changing and thus too is what it means to write (Bazerman, forthcoming). Any longitudinal study will have to gather data on what technological supports are being used, what the human role is within the technological system, and what strategies human beings develop to make most effective use of the technology. These data can include self-reports of technology use and personal response, strategies, and processes, but may also include full keyboard and screen capture, which can then be used as interview prompts.

Educational and Mentoring Supports. In studying development it is also useful to understand the educational, mentoring, and other supports that guide learning and production, and thus development. In the earliest ages this might come from observation of play and learning interactions, along with interviews of the mentoring adults. As children enter organized schooling, curricular documents, lessons, and assignments, as well as possible interviews with instructors to understand their goals, philosophies, and interactions, may provide some understanding—along with information about the technologies used to teach, produce, and support writing. Self-reports may take more of a role as the subjects age and enter the more complex worlds of universities and work. Follow-up with the mentors identified in the interviews or other reports, nonetheless, may also help clarify the mentors' goals and strategies and what they see as the paths of development they are trying to foster.

Reading Data. The virtual world of reading is also important to an understanding of the general literate environment the writer lives in, the resources he or she might draw on, and the specific literate contexts he or she addresses in writing. This information can be gathered as part of the general questionnaires sent periodically and in the specific questionnaires

that accompany submission of texts. With younger children, however, this information could be gathered from caregivers, teachers, and curricula.

Neurological and Brain Data. As writing development will likely be realized in development of neurological resources, getting some baseline of neurological measures could potentially be useful as our technologies for measurement and our knowledge of the relation of neurological architecture to thought and emotion become more refined. Writing processes are hard to capture in current devices such as FMRI, which require subjects to remain still; however, even with current technologies we can get FMRI scans of subjects as they are asked to imagine writing tasks, engage in organizing or other planning tasks, and adopt strategies for various texts or engage in other imaginative tasks. Stationary subjects may also be asked to mentally edit displayed texts. Contrastive scans of subjects more highly engaged with complex writing activities and those less so may also provide clues about the interaction of writing and brain development. Additionally, general measures of short- and long-term memory and executive control may provide insight into the effect of individual difference on writing development. Even more simply, chemical blood assays can determine the elevated presence of anxiety- or euphoria-associated endogenous substances during writing activities. As technology develops and we get a better idea of the relevant processes and associated architectures we are looking for, we will be able to design more relevant and refined ways of gathering data.

Health, Social, Career, Economic, Psychological, and Intellectual Engagement Data. These are all potential input and output data, so it would be useful to capture them in some form. Health may affect one's ability to write, not only as potential impediment, but also positively, as limited mobility or other disability may increase the written channel as the medium of social communication. Health and psychological well-being may also be fostered by writing (see for example, Pennebaker, 1997).

Since writing itself is a form of social and economic engagement, data about the emerging social roles, identities, and career paths that people develop will provide important context to understand the demands, opportunities, and meanings of writing in their lives. Writing also can engage one in the world of ideas, knowledge, and the arts, developing forms of consciousness and stances toward the world.

Conclusion

This review has exposed the difficulties of a comprehensive lifespan longitudinal study of writing development, even as it has also helped identify the parameters of choices to be made. This review has highlighted, nonetheless, how such research, or whatever smaller pieces of it we can manage, will add to our understanding of writing development, and the consequences of that development for lives. It highlights how much people's writing lives are intertwined with the other aspects of their lives, personally and socially, and how those in turn are functions of the time and place in which individuals live and the positions they adopt within that space. This review, in identifying data that might be collected, has helped clarify, at least to this author, a vision of what an understanding of development of writing across the lifespan might look like, and why we might want it. In heuristics begin responsibilities.

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