ABSTRACT
How does an interdisciplinary team with professional training in different disciplines document and redesign a complex business process in just a few weeks? How can they persuade a global client that change is understandable and possible? By using a macroergonomic framework to parse and analyze data and educate and empower stakeholders, this team of user experience researchers and designers simplified complexity within their own process and for their client as well.

Categories and Subject Descriptors
K.6.1

Keywords

1. INTRODUCTION
We work for a design consultancy called Electronic Ink. Electronic Ink deploys interdisciplinary teams to help all kinds of companies improve their business systems and processes. Our company is an eclectic mix of human factors experts, cognitive psychologists, business strategists, interaction designers, writers, content strategists and developers. Clients often come to us with a specific problem and goal; other times, they just come with the feeling that business ought to be going better, faster, smoother, or more profitably. Depending on the client’s industry and challenge, our company pulls together a team to investigate and design a solution. One of our distinguishing factors in the marketplace is our commitment to considering first and foremost what we call the “human context” in any business. As we analyze and develop better systems, our solutions must take into account the physical, psychological and social realities of the workplace.

Our design solutions often consist of streamlining processes within a business. This could include eliminating unnecessary and duplicate steps, integrating disparate systems, eliminating excess data that clogs workflow, and standardizing processes. Each of these is a different way of reducing complexities in a business system or process.

When we talk about complexity within our work, there are really two different kinds of complexity that we must pay attention to: (a) the business complexity of the client and the client’s problem space, and (b) the project complexity in terms of how the client’s project will be planned and executed.

To be honest, though, we rarely have the opportunity to sit back and think calmly about the complexities of individual projects. After the fact, when there’s time and hindsight, we’re usually on to the next big challenge. In working on this paper, we ended up doing a kind of meta-analysis of the project’s complexities and what we’ve learned.

1.1 Business Complexity
As we approached this project report, we began by defining our terms. We all “know” what complexity is, but would we be able to explain it if someone asked us? How often do we really think about how many different types of complexity there are?

There are actually multiple ways of defining complexity within a business organization, and we found two especially useful models. By “useful” we mean that these terms helped us understand and explain to ourselves and our clients some business challenges.

From a macroergonomic perspective, business or organizational complexity is defined by the extent of the existence of structural differentiation and structural integration. [2] Structural differentiation denotes the extent to which the business is segmented into unique pieces, be it horizontally, vertically, spatially, or some combination of these. Think here in terms of departments, locations, or lines of business that operate in relatively siloed fashion. Hospitals, banks, publishing houses, city governments – these are some examples of businesses that are characterized by a high degree of structural differentiation. The more differentiated the structure, the more likely that an organization will need a complex system to achieve “structural integration” – the ability to facilitate interaction between and among the different parts. Think here about the many technologies, roles, and processes that complex businesses put in place to ensure communication, coordination and control over the unique parts. Poor or complicated structural integration can lead to costly errors and employee frustration. If your local bank, hospital or utility has ever been acquired by a larger corporation, you’ve probably had firsthand experience with a sad discrepancy between structural differentiation and structural integration. While you might “belong” to a new bank, it can take quite some time for the larger entity to recognize your existence and communicate smoothly with you.
These perspectives are meaningful to us because they help us parse a complicated organization into different elements as we try to explain the current state of a business and propose and prioritize design solutions.

Other perspectives of business complexity focus on the differences between internal and external complexity. [4] Internal complexity includes the above mentioned differentiation, plus other internal factors, such as products or services produced, technology used, and the employees themselves. In contrast, external complexities are the environmental characteristics that constitute the context in which a business operates. Laws, language, culture, utilities and services available can be external complexities. They may be stable but they may also be highly unpredictable and dynamic, depending on the type of business organization. This differentiation is useful to us as we think about what situations our customers can change (internal factors, like head count, technology platform, office location) and what they can’t change (external factors like legal constraints, inclement weather, the national language, or civil unrest).

1.2 Project Complexity
In addition to the complexity of most large, modern businesses, as a consultancy we are also faced with complexity specific to the project for which are hired. There are varying factors that contribute to the complexity of a specific project. Perhaps the most profound complexity is determined by the project’s scope.

If a client asks us to look into one function, one department or one discrete area of their business, the project feels relatively simple—or at least reasonably contained. However, sometimes we’re asked to investigate and solve for problems or processes that cross departments or divisions or that involve multiple, flawed communication systems. We consider these projects with their wide and deep scope to be complex. To recur to our definitions of complexity, we’re dealing with a high degree of structural differentiation and usually very messy or nonexistent structural integration.

Scope dictates the size and makeup of our project team. Our research teams consist of a researcher and either a designer, business strategist or content strategist. The two-person team can only do so much research in a given project period, so a wider scope might require multiple research teams that work concurrently. The more teams on the project, the more difficult the data analysis becomes. Sometimes there is only one team, but it can still get complicated if individuals are rotated on and off the team because of limited availability. This creates the same problem of bringing the data together for a holistic analysis.

Finally, the timeline of the project can add varying levels of complexity. Short timelines may make in-depth analysis of the problem difficult and can jeopardize our ability to uncover the root of a problem. Long timelines may offer additional hours for analysis and synthesis, but may also weaken focus. Many times a complex process, large amounts of data, and a long time in which to analyze, can tempt us toward a needlessly elaborate explanation of a process.

2. PROJECT REPORT OVERVIEW
The following project report describes two different ways we simplified complexity in a recent project. We had to (a) simplify our internal process for tackling a complex problem and (b) simplify the presentation of that complex problem to the client. Specifically, this report focuses on the methods and outcomes used by our interdisciplinary team to solve a complex problem with a pharmaceutical client’s aggregate reporting process. We also added a third element (c) a kind of meta-analysis of the project complexity afforded us by writing this paper.

2.1 The Project
Electronic Ink set out to understand the process of aggregate report writing for a small pharmaceutical company. The client’s business goals were: (a) improve the efficiency of the report writing process, (b) improve the quality and consistency of the final published products, and (c) reduce the cost of producing the reports. In addition to the business goals, there were personnel goals: (a) alleviate the stress and create a process that allowed for greater employee satisfaction, and (b) determine the skill sets needed for the tasks that had to be completed for the reporting process to be successful. The stakes were high for our client, as they were poised to double their product line in the next few years. They had to achieve scalable ways of communicating better across distinct entities within the business if they were going to thrive.

2.2 The Team
Our company drew from our interdisciplinary professionals to create the appropriate team for this project. The team comprised a researcher with robust experience in corporate settings (cognitive psychologist), a designer with special strengths in dashboarding and the challenges of global companies (interaction designer), and a content strategist with experience analyzing and improving internal authoring and publishing processes (Ph.D. in English). A third researcher with additional experience in highly-regulated, elaborate corporate structures supplemented our efforts during collaborative sessions in our office (human factors psychologist).

2.3 The Research Activities
We conducted a combination of individual employee field observations (17) and group interviews (5). The field observations consisted of 2-hour sessions with individuals in their natural working environment, observing the day-to-day methods for completing their jobs. This included observations of the technologies used, analog work-arounds, process flows, etc. The discovery team asked questions where needed.

The team shared findings and insights daily, via emails, ad hoc conversations and some scheduled check-ins. Under the direction of the lead researcher, the team worked together to pool observations and notes from the research activities. The team parsed our findings, diagrammed the client’s current reporting process and identified pain points where personnel, technology, or an unhappy combination of both were compromising the process or product.

2.4 The Solution
We delivered a “current-state” process map that identified the steps in the process and the technology, personnel, and documents involved in each step in the process. We also identified the difficulties or gaps in the process and made high-level recommendations for redress – such as recommending a change in tools, in timeline, in meeting procedures, and knowledge transfer.

3. COMPLEXITY
3.1 Complexity of Client Process
The client process of aggregate reporting was fraught with complexity from beginning to end. The level of structural
differentiation in the company was great. There existed several different departments responsible for different arms of the business, and within each of these arms, the structure was varied. For example, in the reporting group, there were dedicated product teams that were responsible for knowing the history of one particular product. However, in the clinical department, different people were responsible for different uses of a given product. Two people could work virtually side-by-side, spend their days dealing with exactly the same drug, but know nothing about each other’s work, because each dealt with the product in a different context. To complicate the structural differentiation even further, the company operated in the global market and thus had departments and personnel worldwide.

Integration between the global departments was vital to the success of the organization; however the level of structural integration was fair at best. The communication was fragmented and was not monitored by anyone at the management level. In addition, the methods used for information exchange, another vital aspect for the aggregate reporting group, were inefficient and insecure, putting the company at risk.

The levels of internal and external complexity were also very great. Recent regulatory changes were causing confusion and stress among the reporting team. Teams were responsible for three different reports for each product; each report duplicated some but not all of the information in other reports. Finally reporting periods and deadlines overlapped in many instances, exponentially complicating and intensifying workflow.

Internally, many of the personnel were given tasks and responsibilities outside of their expertise and training. This led to a culture of fear and insecurity both within the reporting department and across the various departments that provided information for the aggregate reports. The global nature of the company also hindered communication with non-US-based personnel.

3.2 Complexity of Project

The scope of the project was to streamline the aggregate reporting process and through this, improve the quality of the reports generated. Thus our focus seemed to be relatively small – “just” the one group. Once we began interviews, it soon became clear that the single group had to interact with people across several other groups. Thus our primary focus on the aggregate reporting group quickly gained a secondary focus on the interactions with other departments. To understand these interactions, we had to investigate at least the basic workings of each department. In other words, as we realized we needed to understand the structural integration of the company, we were slipping into the dreaded “scope creep.”

While there was only one team assigned to the project, three individuals from three different backgrounds were conducting field observations. With three people participating in the observations there were three sets of notes from three different perspectives that needed to be reconciled. These notes, handwritten and taken on the fly, contained both overlapping and unique information. Sorting out the wheat from the chaff was a complex problem in and of itself. The scope creep added research inquiries leaving only one week for data analysis, explanation and high-level recommendations for the client.

3.3 Simplification!

3.3.1 Simplification of our process

The macroeconomic framework pictured in Figure 1 lent itself well to the challenge of bringing three sets of notes together for analysis. [1] The framework defined the business context – from external complexities down to internal tools. The levels in the framework equated roughly to the elements involved in our client’s process.

![Figure 1. Macroergonomic Framework](image)

Our client’s aggregate reporting process had complexities from the outermost level (societal and cultural pressures) down to the level of the physical setting and devices in which individual employees involved in the process worked. Each category in the diagram above could correlate to a contextual element that posed constraints on the aggregate reporting system.

By explaining the levels described in the diagram and assigning each one a color, our lead researcher was able to have each member of the CI team parse his or her notes onto a colored “post it.”

On the walls of the project room, she placed posters representing the key internal elements that made up the aggregate reporting workflow (the individual reports involved, the various software systems, and the departments). Team members placed each observation on the appropriate poster to create an affinity diagram that took up all four walls of the project room (See Figure 2).
Note in the photo above that colored (and therefore conceptual) patterns began emerging as the colored post-its were used in affinity diagramming. A huge amount of data was parsed in just one afternoon as each team member dropped by to participate in the diagramming (another simplification—no need for rigid scheduling – our project manager was delighted).

As we completed our affinity diagramming, we also took breaks to create what we called the “real” workflow (See Figure 3), a diagram that reflected the inputs and sequence of events behind the client’s aggregate reporting process. We called it the “real” one because the way things got done deviated in ways small and large from the official workflow that the client management had described to us before we observed the process itself. It took the entire team’s observations to construct the workflow diagram – but when we finally deemed it complete, we had an excellent point of reference. We referred to it frequently during analysis as a means of pointing out problem areas and suggesting workflow adjustments.

These seemingly small and decidedly non-technical methods both simplified and deepened our process. This method not only allowed all team members to put their data into the mix, it also gave the designer and content strategist an unusual level of involvement in the act of analysis along with the researcher.

It was a natural, even organic progression from slapping up post-it notes to discussing categories, identifying overlaps or more nuanced observations, to discussing the meaning and implications of the emerging structure. When the project moved on to design phases and to further discussions with the client, all team members were nearly equally able to explain our findings and recommendations.

3.3.2 Simplify a complex message
As a business, our own success depends upon simple and clear presentation of our findings and recommendations. Usually, we are delivering our work to a subset of people who will have to “sell” our findings to their colleagues and management. A win with our immediate client contacts does not necessarily mean further business or a phase two project. It behooves us then, to think carefully about how we’ll share our findings. Part of our job, then, is to deliver our advice in a way that the client, a non-specialist, can then use as a teaching tool within his or her organization. The stakes are doubled, in other words, as we find ways to share our findings and recommendations

While we managed to simplify the complexities within our team and methodology to provide a quick, insightful and robust set of findings for ourselves, we still needed to find a way to deliver this material simply.

Years ago, our business was likely to create detailed written reports to communicate findings to our clients. Over the past few years, however, we have found the appetite for reports has been supplanted by the desire for quick, easy to digest visuals. Thus, we put as much of our design expertise into the way we present solutions as we put into the solutions themselves.

3.3.2.1 Clarity supports simplicity
Because our macroergonomic framework used laymen’s terms, we were able to share both the Figure 1 and Figure 3 activities with our client. Moreover, we arranged to have them visit our project room periodically, a practice our company embraces, so clients can see what we’re doing. Did the client understand absolutely everything we were up to? No. But they got the idea, they got to ask questions, and they saw firsthand the sophisticated thinking that was going in to our seemingly simple design solutions.

3.3.2.2 Visual artifacts spread insight easily
Rather than delivering a simple as-is workflow diagram showing sequential steps and the tools used, we layered on icons indicating at a glance the level of frustration or conflict involved in each step. The deliverable (which we cannot provide here due to confidentiality agreements) gave the audience “the whole story” of the process – not just the “what” but the “how” and the “so what” of the process. They were able to follow the timeline and understand:
- Roles involved
- Data inputs
- Data outputs
- Technology used
- Emotional climate at each step

This “as-is” workflow served as a potent foil to the “future-state,” redesigned workflow that we offered later in the project. Our client was able to compare and contrast the redesign to the current state. Most important, the client was able to use both versions of the workflow to advance their strategic plan throughout the company. By offering a simple, intuitive artifact, we helped them advance toward company acceptance of the redesign.

We supplemented these findings with other tools that would help the client see and understand our solutions. By rearranging work groups and providing accurate, industry standard description of qualifications and roles, we were able to show how with just a few new hires, the workflow could be improved.

3.3.3 Simplifying choices by predicting outcomes
Before we could create a finalized, future-state vision for the client, we had to hear their concerns and help them envision how
any number of smaller decisions about timing training, headcount and technology might affect outcome.

We created a simplified macroergonomic framework to help the client see what kind of impact different decisions might make (see Figure 4). The pyramid below proved to be an excellent way of showing the client that an organizational change (top of pyramid) while difficult to implement, could affect the entire company structure and culture. A change at the individual or team level would help locally, but would not advance company-wide change. Put another way, structural integration would not be improved directly by local change within a single department or location.

![Figure 4 Decision Impact Pyramid](image)

3.3.4 Client outcome

Redesign is only the first step of implementing change in a business. Currently, our client is in the early phases of implementing our redesigned workflow. The gratification of seeing our research and recommendations played out in the real world is tempered by how long it takes a complex business to change course. Nonetheless, not every client manages to begin making changes mere weeks after we deliver our findings, as this client did. We believe that the many ways we simplified complexity gave our client the confidence and energy to begin changing right away.

4. LESSONS LEARNED

4.1.1 Revisit your approach basics

Our company ideal is always to engage all the disciplines in the work—from sales through delivery and scoping further work with a client. Using frameworks, as we have shown, brought us much closer to this in reality. We thought of ourselves as seasoned collaborators, nonetheless, approaching the work this way introduced some growing pains. We’d like to share them here in hopes that anyone tempted to follow our example will enjoy smoother sailing.

Communication must grow to keep up with growing collaboration.

When designers participate in research and analysis; when researchers scrutinize design deliverables; when designers weigh in on a written findings and recommendations report, it can be hard to maintain a single thread of communication. Throughout the project, we found ourselves stumbling and backtracking in lots of little ways because we were not all clear on who was done with what.

Projects that embrace this method of collaboration should reinforce the need for a unified communication channel. Create an email circulation list and stick to it, so everybody sees everything. Commit to clear and succinct subject lines on those emails, so team members can respond efficiently and appropriately. Schedule regular short meetings (15 minutes per day) as well as a longer weekly meeting that allows sufficient time to make sure everybody is up to speed and knows what to do next. It’s tough to figure out when a casual conversation between two team members arrives at a point that should be shared with the whole team. Use these regular meetings to help strike the balance between formal and informal communication.

Don’t throw out clear definitions of roles and responsibilities.

It is very difficult to enable such collaboration, yet make sure that the person with the appropriate expertise and experience is still making the decisions that matter. Fortunately, we avoided turf wars—everyone was pretty excited to have a chance to be more involved in all phases of the work, and that good spirit prevailed. Nonetheless, we were surprised at how muddy some decisions became. We considered ourselves veterans of collaborative work at the company, yet we were surprised at how this method launched us into some very muddy decision-making waters. Although we were a pretty confident bunch (in ourselves and in each other) we’d be lying if we didn’t acknowledge that we each felt a pang of “Hey, back off, you novice!” at one or another point in the project. We recommend that at the internal project kickoff, the project manager clearly establishes who has the last word on which decisions and deliverables. This will help everyone be more flexible and open in the work leading up to decision points.

Summon your best project manager.

If you have worked in industry, you already know how vital the project manager is for any project. Using the framework added significantly to the challenges of the project manager. As the last vestiges of serial workflow crumbled (“handing off” research to design, for example,) the PM found himself with more people in more meetings; more review threads to track, and, let’s face it, more personalities bouncing off each other more often, week after week. This is not for the faint of heart. The PM has to be willing and able to keep the team on track and working within the established roles and responsibilities, even as he or she faces complaints when somebody feels suddenly ‘left out’ of this new collaborative extravaganza. Put your strongest PM on the job and empower him or her. As he or she gains experience, promote knowledge sharing and mentoring to bring less experienced PMs up to the task. And remind everybody at the outset that this is a new challenge and as such, the PM needs clear, constructive feedback.

4.1.2 Take what you’ve learned and think big

Mine what’s out there and adapt it to your needs.

After this project, we were further convinced that applying frameworks to data gathered by interdisciplinary teams was an efficient way to make the most of the abilities and insights of the team. As a result, our research group has an ongoing practice of surveying and gathering what we call “flexible frameworks” and sharing them across the company. We chose our name deliberately: in a company full of designers and researchers, anything smacking of mass production or proscription is bound to meet with resistance. Our goal is always to give people enough structure to facilitate collaboration and kick start analysis, not to shortchange the analysis or its outcomes.
Encourage reuse.

We found that certain aspects of working with the framework could apply to other clients within the same industry. For example, once we had articulated basic aspects and challenges of the safety and regulatory context for our pharmaceutical client, we had language and elements that would be applicable, with some tweaking, to other clients in that industry. We’d also created a cross-disciplinary team that knew more than any of us ever thought possible about reporting and compliance within the drug industry. Similarly, the work helped us build some basic language and thinking around tiers of management and business strategy. What’s significant here is not just that some of the material can be reused – it’s also the fact that we’ve now got a team that includes designers in thinking about how companies imagine and deploy business strategies and tactics. This isn’t always something our people learn within their disciplinary training.

This is just the beginning of what we believe we’ll do with frameworks. The method is helping to develop expertise within the company while delivering holistic, impressive solutions to the client.

5. Conclusion

By working together on this paper, we have enjoyed the rare opportunity to look back at a project from a brief respite and understand its implications. Writing solidified certain ideas and bolstered them with expert research. We now share a common vocabulary with which to analyze business structures and processes. Structural differentiation, structural integration, internal complexity, and external complexity are just a few. Sharing a common vocabulary is crucial and rare within interdisciplinary teams and these more clearly articulated concepts are even more compelling when we think about presenting to clients. As we bring this to a close, we can also appreciate that the project described and the paper you have just read have given us valuable insights into making our own processes more efficient and we can truly say we’re actually using our expertise on our internal organization.

6. ACKNOWLEDGMENTS

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7. REFERENCES


