Towards a Toolkit for Interaction Design: Thoughts on Theory and Method

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In November of 2003, Interaction Design Institute Ivrea convened a symposium on the Foundations of Interaction Design that brought together about thirty scholars and designers. The aim of the symposium was to initiate a discussion that would lead to the development of a structured view of the theoretical foundations of interaction design.

I approached the symposium with a bit of trepidation. The fact is that I don't have a theory of interaction design. Nor do I have a firm idea of its foundations, or how they ought to be structured. On the other hand, as an interaction designer, I do have a clear (if, perhaps idiosyncratic) vision of what interaction design is and of how I go about conducting my work. And I have firm beliefs on what those studying interaction design ought to learn and what experiences they ought to have during their training. Perhaps amid these visions and beliefs there lurks an implicit conception of the foundations of interaction design.

As a participant, I greatly enjoyed the symposium. The speakers were excellent, the talks thought provoking, and the in-session discussions stimulating. I met intriguing people, and had many provocative discussions between sessions. I came away with some new ideas, and perspectives. But I didn't feel that I—or others—made much progress towards developing a structured view of the foundations of interaction design. To me, it feels as though interaction design is inchoate, still coalescing out of a number of diverse fields. I'm concerned that it is too early to impose structure; rather, I think we are still at the stages of trying to arrive at a shared conception of what interaction design is, and what constitutes suitable material from which to construct foundations.

In this essay I explore these issues. I begin with the question of what interaction design is, and discuss my own view of interaction design, trying to partition up the field in a pragmatic way. Next I discuss the role of theory in interaction design, taking issue with the claim that the tendency to use 'secondhand' theory is problematic; instead, I suggest that secondhand theory is fine provided that we are careful about what we choose to use. I suggest that a good way to begin is to be pragmatic, and to begin assembling a toolkit of concepts for interaction design that consists of appropriately sized theoretical and methodological constructs. In the third section I offer a candidate for inclusion in this proposed interaction design toolkit, explaining why I think it suitable in terms of its nature and scope. I conclude with reflections on ways to move forward.

Five Lenses for Interaction Design

I'll begin with my view of interaction design. I'll start with a definition, and then provide an example that—from a practical, designers-eye point of view—illustrates one way of partitioning the concerns that attend interaction design. As I do this, I will point to a number —though by no means all—of theoretical stances that I draw upon in my work.

Interaction Design

I define interaction design quite broadly:

> Interaction design has to do with the design of any artifact, be it an object, system, or environment, whose primary aim is to support either an interaction of a person *with* the artifact, or an interaction among people that is *mediated by* the artifact.

Although some see interaction design as particularly concerned with digital systems—either computer systems or artifacts with embedded computational capabilities—I see no reason to exclude humbler artifacts. The basic forces that shape our interactions, from perceptual and motor processes such as seeing and touching to social and cultural phenomena such as imitation and fashion, are agnostic with respect to whether an artifact contains digital components. Indeed, much of what we understand about the design of non-digital artifacts—whether it be how to make a switch with a satisfying 'click,' or how clothing functions as a means of expressing identity—are applicable, as well, to digital systems. Finally, as computer systems melt into walls, and even the most mundane objects are tagged and tracked by digital systems, our ability to discriminate between the digital and the non-digital will fade, even should we wish to maintain it.

A Canonical Example of Interaction

I am looking at a picture of two people playing chess. One player sits gazing at the pattern of pieces on the board, rapt in concentration. The other player is out of the picture, except for a hand reaching in to grasp a king. To one side of the board a number of captured black pieces are gathered together in a group; to the other side is a pair of chess clocks that the players use to meter out their allotted minutes. In the background we see bystanders watching the game with interest, as well as passers by who are oblivious, intent on other matters. And yet farther back we discern trees and buildings, and see that the game is taking place outdoors in a city square.

To me, this picture represents, in miniature, the terrain of interaction design. As such, I wish to use it to describe how I go about making sense of interaction. As a designer, I am continually confronted with new sites and situations, and for each one, I need to come up with a way to see it, to analyze it, to design for it, and to understand the consequences of what I have designed. I find that I work best when I orient to the site or situation in which the interaction takes place—for me the site comes first, and the conceptual framework and methods and tools come later. As a designer, my principal challenge is to make sure that I don't get too fixated on a single aspect of the situation, that I don't get trapped in a

particular perspective or approach. Rather than find a single conceptual framework that fits the situation, instead my aim is to stay grounded in the concrete reality of the site, and to bring a range of conceptual lenses to bear on it.

Five Lenses

So let us return to the picture of the players at the chessboard in the city square, which I hope you can see in your mind's eye (but, if not, see [29]). I will walk you through the picture, giving you a brief glimpse through the set of lenses that I bring to bear on the sites with which I engage.

Mind

I begin, perhaps as a consequence of my early training, with the mind, envisioning the game in purely cognitive terms. Playing chess, viewed through this lens, involves a cycle of perception, cognition and action. This is the domain of cognitive psychologists, such as Donald Norman [20, 21], and is concerned with issues such as how people might go about learning chess, what sorts of errors they might make while doing so, how players develop strategies, why people find games of this sort engaging, and so on. This is the lens most often deployed by interaction designers versed in human-computer interaction, and is of critical import in the design of digital systems.

Body

Moving on, we deploy a new lens, shifting our focus from mind to body and its visible behavior. In the picture we see a number of bodies: the player in the foreground, his face rapt in concentration as he gazes at the board; the hand of the opposing player, reaching out towards the black king; three bystanders gazing at the game, in postures that indicate that they have settled down to watch for a while; and a passerby, in mid-stride, apparently not aware of the game taking place. This is the domain of ethnomethodologists such as Adam Kendon [16], and sociologists such as Erving Goffman [10, 11], who focus on the role of expression, gesture and posture in conducting interactions amongst small groupings of people. This lens is important for both those concerned with designing material artifacts as well as those designing digital systems which support mediated (i.e. disembodied) interaction.

Artifacts

Next we shift our view to the artifacts in the picture. We see a chessboard arrayed with white and black pieces, with a hand reaching for the black king; off to one side we see a cluster of captured black pieces, and off to the other a pair of chess clocks. These artifacts play a variety of roles, interacting with the views from other lenses. One role of artifacts, that Norman explores in *Things that Make Us Smart* [22], is to ease the cognitive load: the board and the pattern of pieces on it serve to depict the state of the game, enabling players to focus on planning their next moves. Another role of artifacts is depicted by Ed Hutchins in *Cognition in the Wild* [14], in which he explores the view that cognition is not just a property of minds, but can be seen as a global property of systems of people and artifacts. A third role of artifacts is their status as objects that are manipulated by the participants. While the manipulation of chess pieces is a relatively simple matter, ethnomethodologists like David Sudnow demonstrate that the ways in which people

physically interact with objects is incredibly subtle. In his book, *Ways of the Hand* [25], Sudnow provides an exquisitely detailed account of the process of learning improvise jazz on the piano, and the ways in which his hands (not his mind) learned to traverse the keys. A fourth role of artifacts is a social one, in that the pair of clocks substitute for a human time keeper. This view is explored by Bruno Latour [17], who eloquently argues the case for a sociology of artifacts, suggesting that it is artifacts which stabilize and extend human interaction patterns. This lens—with the glimpses it gives of artifacts and their varied roles—is important for those who design material artifacts, as well as for those who aim to replace material objects with digital 'equivalents.'

The Social

Now we move to a level of analysis that is not explicitly grounded in anything that can be found in our picture. The social lens examines relationships, both among people and between people and objects, and tries to take notice of the norms and rules that underlie them. Thus, in our picture, we see not just people, but people who stand in relationship to one another—players, spectators, passersby—and who are obeying rules as a consequence. Of course, the game of chess has a set of rules associated with it, but of more interest are the unwritten rules being adhered to. Thus, one chess player does not shout at the other as he ponders his move (something which is permissible in games like baseball), nor does he, after capturing a piece, toss it into the dirt beneath the table. There is an unarticulated notion of "proper" behavior in play, and one that, furthermore, extends beyond the game. Thus, the onlookers watch quietly and refrain from offering advice (again, unlike some other games), and one, standing nearby, appears to be waiting his turn to take on the winner, thus participating in an unarticulated but mutually understood notion of turn-taking. This is the realm of social psychology, sociology (Goffman [11], again), ethnomethodology [13] and anthropology [12]. This lens is essential to any interaction designer wishing to reflect upon ways in which a newly designed artifact may disrupt situations in which it is introduced, or the ways in which—as with a web-based chess game—the digital equivalent of a face to face interaction may have very different social effects.

The Ecological

The last lens I'll discuss gives, by far, the broadest view. It is the view of the interaction as it is situated in its larger context. Here we look not just at the chess game and its audience, but at its temporal and spatial location. Temporally, this chess game is a fixture, recurring nearly every day, in the same location—out of doors in a public space. By virtue of its location, passersby, on their ways to other places, become aware of the game and, over time, notice that it is a recurring event. Perhaps, another day, when on less urgent business, one passerby may pause to watch and even to play, thus helping the game, as an on-going even, to sustain and extend itself. Even if the game fails to interest most passersby, it still plays a small but real role in contributing to the liveliness and interest of the urban space. This lens, looking at the ways small interactions like the chess game flourish (or not) in the context of other interactions, is exemplified by the work of urbanists like Jane Jacobs [15], urban designers like Kevin Lynch [18], architects like Christopher Alexander [1], and anthropologists like William Whyte [27]. This lens is

crucial for the interaction designer who creates artifacts for use in public places, and wishes to create self-sustaining interactive systems.

About the Lenses

I do not wish to argue that there are five and only five lenses of use to interaction designers. Indeed, if the truth be told, the lenses serve more as a rhetorical ploy than as codified perspectives I wish to promote. The main point I wish to make is that there are multiple levels—or perspectives—from which interaction designers can analyze the sites or situations with which they are confronted, and that designers will fare best when they are able to pick up one lens, then another, and then a third. It is the ability to fluidly shift perspective that is, in my opinion, of most value to interaction designers.

While, as I have described the lenses, I have mentioned various scholars as exemplifying that view, I need to state two cautions. First, my selection of names is idiosyncratic—the work cited has served as a touchstone in my thinking, but I am well aware that others could and would come up with different sets of names and theoretical. Second, the work of those I've mentioned typically extends beyond the perspective with which I have associated them. The lenses I have suggested are deliberately simple so that it is easy to see how they map onto any site or situation; however, those scholars I've cited are not so simple, and typically range beyond the simplified foci of the lenses I've presented.

Theory in Interaction Design

Now I'd like to turn to the question of the role of theory in interaction design.

The motivations for the symposium, as laid out in its brief, begin with a concern that "*the field of interaction design is a state of uncertainty, with too many definitions and blurred borders*." There is no unified theory of interaction design; rather, theories from other areas are used in an "*opportunistic*" fashion to help analyze and structure particular areas, and tools and methods are adapted from various background. If theories and methods in interaction design share one common characteristic, it is that "*they are often secondhand*." The consequence of this situation is that it "*makes communication difficult, both within the field, and, what is more dangerous, with other fields that might be possible users*."

I have mixed feelings about this rationale. On the one hand, I agree that interaction design has its problems, and that foremost among them is that communication is difficult due to a mélange of different concepts, terms and methods. On the other hand, I am not convinced that the source of the trouble is the 'opportunistic' use of 'secondhand theory.' I am, in fact, quite in favor of opportunistic behavior, at least if it means the ability to fluidly select from a range of alternative conceptual approaches based on the requirements of a particular situation. Nor am I sure that the remedy implicit in this diagnosis—the development of a firsthand or native theory of interaction design—is necessary or desirable.

In my view the subject matter of interaction design is too vast and too diverse to be spanned by a single theory. As I tried to illustrate with my description of the five lenses,

everything from cognitive processes in the brain to the socio-cultural processes that shape urban environments can have a bearing on interaction. Certainly they do in my practice. Rather than secondhand theory being a problem, I think it is a benefit! We have a remarkably broad array of disciplines generating conceptual and methodological tools that interaction designers can make use of.

In my opinion, the problem for interaction design is not the use of secondhand theory, *per se*, but rather the selection of which theory (I will now drop the 'secondhand') to use. I believe the problem is one of granularity. It is not clear what the proper scale of theoretical construct is, and often we err by seizing on apparently useful concepts without sufficiently understanding their contexts.

As an example, consider the notion of "affordance." Affordance, a concept originally developed by ecological psychologist J. J. Gibson [9], is now widely used (and misused) in interaction design. As initially defined, it was a relational concept, denoting the possibility of an interaction between an organism with particular characteristics and an artifact with particular characteristics. Gibson developed a very sophisticated argument—drawing on a number of concepts ranging from "affordance" to "agent" to "ecology"—that organisms perceive their environment in terms of affordances. "Affordance," as Gibson used it, has little to do with its popular use in interaction design as a visible indication that something can be done (visibility has nothing to do with affordances), nor does it make any sense to talk about an artifact affording something without also specifying the sort of entity to which the affordance applies.

At the same time, I think we need to be cautious about adopting full-fledged theories from other disciplines. The reason is that theories play multiple roles. At its most basic level, a theory is a useful simplification, a mechanism for imposing a framework on the blooming buzzing confusion that is reality. To the extent that its basic components are understandable and memorable, theories serve as common frameworks, *lingua franca* that allow insiders and outsiders to speak to one another using a common language and shared concepts. Thus biological concepts such as "disease," "bacteria," "virus," "germ," "infection," "antiseptic," and "antibiotic" provide both specialists and layfolk with a common ground through which they can understand and discuss basic medical issues. However, theories also play a number of roles within a discipline. In particular, a theory can serve as a framework for debate within a discipline and, as a consequence, over time the theory is articulated and refined in response to the debate resulting in a more complex theory, or possibly multiple versions of the theory.

These two roles of theory stand in tension to one another: the utility of a theory for promoting debate and further articulation of itself within a field may actually interfere with its utility in communicating beyond the field. The requirements for promoting articulation within a field involve supporting the creation of distinctions and nuances that can serve as the ground upon positions can be established, whereas the requirements for communicating beyond a field require the ability to depict the conceptual framework in a few bold and broad strokes of the brush. While the ability of a framework to support the

finely detailed nuance is not necessarily at odds with the ability to also serve as a simplifying framework, it often is.

What this boils down to is that we need to think carefully about the theoretical constructs we choose to use in interaction design. We need constructs that are neither so large that they bring along all the analytical baggage developed in response to internal disciplinary debate, but not so small that they lose the ability to provide a useful framework for dealing with complexity that makes them useful in the first place. In short, we need a conceptual middle ground, a repertoire of theoretical constructs that are larger than "affordance" (or "breakdown" or "flow"), and that are smaller than "activity theory" (or "distributed cognition" or "ethnomethodology"). I believe that rather than trying to come up with a structured view of the foundations of interaction design, we need to begin simply by identifying which theories and methods are useful to interaction designers. I propose we begin by assembling a conceptual toolkit for interaction design.

Towards A Toolkit for Interaction Design

What sort of theories and methods belong in a 'toolkit' for interaction designers? What is the right size or granularity of a theory or method? And how do we go about deciding? I don't have good general answers to these questions. One possibility is that suitable theories and methods already exist, and that we simply need to carefully and reflectively choose from among the many possibilities. Another possibility is that we need to take theories developed by other disciplines and simplify them for our purposes, pruning away the complexity generated for internal disciplinary purposes—this is something along the lines that Don Norman has suggested in his proposal for an applied discipline of Cognitive Engineering [20]. Another third possibility is that a more radical form of simplification is needed: elsewhere I've proposed that adapting the notion of pattern languages from architecture [1] might provide a way of creating a *lingua franca* for interaction design [6, 7] that would foster communication amongst the diverse constituencies which make it up.

In this section, I will describe an example of what seems to me to be a theory of the right size to be in such a toolkit. I'll lay out the reasons that I turned to it, provide a succinct description of the theory and why I believe it is useful to interaction designers; and as I do this I'll give some references into its literature for those interested in pursuing it. I will also suggest a few other candidates—without going into detail—for such a toolkit. I hope that, over time, other interaction designers will investigate and challenge my suggestions, as well as putting forward their own candidates.

Conversation, Community and Genre Theory

For the last decade, much of my work has been focused on supporting online conversation amongst distributed groups. I initially used the concept of virtual community—still a popular construct within interaction design—to frame my work. However, I quickly became disenchanted with this as an approach. On the one hand, the meaning of "community" as used in ordinary language was quite vague, covering the ground from small groups that intentionally come together to vast numbers of people

involuntarily united in various conceptions of racial, ethnic and national identities. This was too vague to provide analytical value—it didn't help me come to grips with the complexities with which I was trying to grapple. On the other hand, when I turned to the literature in sociology and related fields, I found a very elaborate (if never entirely agreed upon) conception of "community" connected primarily with geographically proximate groups. While this had enough specificity to be helpful analytically, neither the conceptual framework nor the analytic methods it suggested applied very well to the distributed groups I was interested in studying.

As a consequence of these and other concerns, I decided that since the 'communities' I was studying interacted primarily by typing messages to one another, and that about all that I could see of them were structured collections of text, that perhaps theories from literary analysis might be helpful. After a bit of exploration, I encountered a conceptual framework known as genre theory.

Genre Theory

Traditionally, a genre has been seen as something that has particular regularities of form and substance. The concept has been used to taxonomize various types of speech and writing (and originally painting). Over the last two decades, scholars in rhetoric and literary theory have developed a new, more situated view of genre that explores the relationship between the regularities of form and structure of a genre and the situation in which it is enacted. This situated form of genre theory (sometimes known as North American genre theory) is most often traced to Miller's 1984 paper [19], and has been elaborated by other scholars including Bazerman [2], Swales [26], Berkenkotter and Huckin [3], and Yates and Orlikowski who first applied it to digital media [28].

In this new view, genre is still seen as having regularities of form and content, but the focus is shifted to the ways in which genres arise out of a recurring communicative situation. That is, the regularities of form and content which characterize a genre are not arbitrary historical accidents, but instead are shaped by a confluence of technical, social and institutional forces which comprise the communicative situation, and out of the attempts of the genre's 'users'—the discourse community in genre theory parlance—to achieve their communicative ends in that situation. While there is no universally accepted definition of genre, the following is a reasonable synthesis:

> A genre is a patterning of communication created by a combination of the individual (cognitive), social, and technical forces implicit in a recurring communicative situation. A genre structures communication by creating shared expectations about the form and content of the interaction, thus easing the burden of production and interpretation.

Analyzing Genre

Analyzing an instance of a communicative practice as a genre means understanding:

- the communicative goals it supports
- its conventions (of both form and content)

- the underlying situation (in both its technical and social guises) in which the genre is employed
- the relationship between the underlying situation and the genre's conventions
- the discourse community of those who enact the genre

To make this less abstract, let's analyze an example of a familiar paper based genre, the job résumé, in terms of genre theory. First, the communicative goal of a résumé is to present information that will enable its author to get a job. Résumés follow many conventions of form and content in supporting that aim: for instance, they tend to be short, highly structured, and they contain job-related and contact information. Many of the résumé's conventions emerge from situations in which it is used. For example, its highly structured form enables it to be scanned quickly by managers reading through stacks of résumés. Its form is also influenced by technical factors—for example, the use of desktop publishing to produce printed résumés has probably increased the use of structural features such as bold and italic text in preference to uppercase and underlined text, stylistic features that could be produced on typewriters. And social and institutional conventions (ranging from unwritten rules to legally established strictures) influence the content of resumes: thus, résumés rarely contain mentions of personal characteristics such as race, height or weight, or musical preferences. Thus, technical and social forces combine in shaping the conventions of the résumé genre. Finally, the discourse community of the résumé genre consists of those who produce and consume résumés, as well as the business segment devoted to assisting in the creation of effective résumés.

Applying Genre Theory to Interaction Design

I find genre theory very useful in trying to understand interactions among people that are mediated by artifacts. In particular, I've used genre theory to analyze what are often called virtual communities [4, 5]. Genre theory has been useful because it shifts the focus from community (e.g. the nature of relationships among community members; generalized reciprocity; etc.) to the structure of the texts produced by the group's interactions, and the various technical, social and institutional factors responsible for this structuring. This shift provided a useful view of the ways in which the design of the online system supported (or inhibited) the types of interactions occurring within it. I also appreciated the shift in focus because a number of the online interactions in which I was interested did not fit well with traditional definitions of community—e.g. situations like online auctions and ecommerce sites in which most interactants were *not* 'regulars', but were one-time or few-time participants.

While genre theory, as it has been developed for analyzing paper-based texts is quite useful on its own, it is also clear that new issues arise when it is applied to digital media. Traditional paper-based genres—because of the time and cost involved in producing and disseminating paper publications—typically have a marked separation between producers and consumers, and such genres tend to evolve slowly. Neither of these conditions holds in the digital world. Digital genres have the potential to be much more participatory, and to hence evolve much more rapidly (e.g., [5; 24]. This leads me to conjecture that whatever theory interaction designers take up, it is likely to change as it is applied to new ends.

Other Candidates for the Toolkit

There are, of course, many possible candidates for inclusion in the toolkit. Over the last several years, my colleagues and I have been developing the construct of social translucence, which is an approach to thinking about the design of systems that emphasizes the production and use of shared awareness. [8]. Another example that came up in the course of the symposium is an area of Economics known as mechanism design, which examines the ways in which systems of incentives are designed to shape large scale group behavior [23]. And yet a third is Norman's proposal for an applied discipline of cognitive engineering [20], which could be much more tractable for interaction designers than the multiple theories that comprise cognitive psychology.

Although I have emphasized theories in this paper, I do want to add that methods are at least as critical. And I believe that, in the same way interaction design has tended to borrow theoretical constructs that are divorced from their contexts, so have we tended to borrow methods without a full appreciation of the assumptions that underlie them and the subtleties required to apply them properly. Surveys are not simply lists of questions, nor interviews informative chats, nor ethnographies spending long periods of time observing people. Rather, in their home disciplines, they are complex practices with nuances that most interaction designers who claim to carry them out are unaware. We need, if only for the sake of validity, to ensure that the theoretical underpinnings of useful methodologies are retained.

Concluding Remarks

I've used this essay to develop my thoughts about interaction design as a discipline. I began with a definition, and my own pragmatic way of approaching interaction design problems. I've talked about the roles that theory plays in disciplines, and suggested that it is a bit too soon to construct a theory of interaction design, or even a structured view of its foundations. Instead, I've suggested a more pragmatic approach that begins with the assembly of a 'toolkit' of theories, concepts, and methods for interaction design, and made a small contribution to it.

As I've worked through my thoughts in developing this essay, I've become more optimistic about the effort to start a discussion on the foundations of interaction design. One of my conclusions, however, is that "foundations" is not what is needed. As a metaphor, "foundations" suggests a solid base on which a single, unified edifice will be erected. And it implies the existence of a stable, well organized community with a shared set of values that is ready and able to embark upon a construction project.

To me, the state of interaction design feels considerably more primitive. Rather than an organized group or community, interaction design feels much closer to being composed of a number of roving tribes who occasionally encounter one another and, finding the encounters engaging and provoking, arrange to have other encounters.

Even were we to remain together long enough to embark on a construction project, I suspect it would soon found on differences in values, experiences and training. Instead, I

suggest that rather than joining together to construct foundations, instead we would be better advised to start more simply, sharing our tools—i.e. theories, concepts and techniques—and trying to apply them in our own territories. When we encounter one another again, by virtue of our attempts to use some of the same tools for different ends, we'll have a bit more common ground, and a new set of experiences to share. It seems to me that this grassroots approach is, if not *the* way to proceed, at least one vital element in making progress.

As yet, there is no generally agreed upon discipline of Interaction Design. Disciplines come into being over time. As a subspecies of culture their formation can be facilitated and their evolution guided, but I do not believe that they can be designed. Just as most individual's only become fluent in a language when they are exposed to it from birth, so, in my opinion, do disciplines only become codified when a generation of designers comes of age within the discipline. And interaction design is not there yet.

I think the most critical needs in developing a discipline of interaction design are schools, conferences and publications that are focused on interaction design. While Interaction Design Institute Ivrea is an important and pioneering step in producing such a discipline, at the moment it is one of a kind. There are no conferences devoted to interaction design, though conferences like CHI, DIS, DUX, welcome some types of interaction design in some venues. Similarly, there are no journals, magazines or book series focused on interaction design, *per se*, though there are, of course, venues where it is welcomed. This lack is critical, because it is within venues that support discourse focused on interaction design that theories, methods, criteria, critiques, and the other elements that give rise to a healthy and coherent discipline will coalesce. The Ivrea Symposium on the Foundations of Interaction Design is an important first step, but it seems to me that the path is necessarily a long one that will require sustained support from those interested in seeing Interaction Design mature into a discipline.

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