**From interaction costs to interaction design**

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## Introduction

Interaction as mutual or reciprocal action or influence has been studied extensively in both natural and social sciences. It encompasses a broad array of situations and widely varying subjects: individuals, objects, animals, plants, organs. Almost all of these can interact between them and among them. Interaction can take place in very different contexts, and can be conflictual or cooperative. Humans in particular can interact directly or through more or less sophisticated objects. Sometimes humans interact by means of other humans who act as intermediaries. Given the choice, humans may not want to interact. On the other hand, they might want to interact, but not be able to.

More important, the results of interaction can be extremely varied, ranging from very good to very bad. In economics, the most studied interaction is carried on in the market by a seller and a buyer. Typically this is a conflictual interaction between selfish agents driven by reciprocal advantage, the lure of an ex post situation better for both parties. Interaction of selfish individuals can make everybody better off. This is the miracle epitomized by Adam Smith's invisible hand. Self interest is harnessed to greater good, "led by an invisible hand" to promote an end which was no part of anybody's intention. This is probably one of the most striking case of virtuous interaction. However, it can be much more problematical and less favourable to social welfare.

Interaction, therefore, is a very complex phenomenon and it would be futile to search for a general theory. This has clear implications for the subject at hand: interaction design. It is inevitable to draw a perimeter and to choose a well-defined perspective.

As an economist, the approach I suggest in these notes is founded on the notion of interaction costs and on the assumption that interaction design should be geared to making those costs as low as possible. Reducing those costs will, in general, enhance social welfare. This is the reason why interaction design may be considered as a socially relevant task. In what follows I shall introduce the notion of interaction costs, stressing the link of such costs to risk. I shall ask whether these costs have been increasing over the past few years as a consequence of important developments related to technical progress and globalisation. Then, I will consider the origins of those costs and the possibilities of reducing them. I will stress that there are cases in which the reduction of interaction costs is of high social value, though by no means easy to achieve. Interaction design, I suggest, is particularly necessary.

Starting from interaction costs it is possible to define quite precisely the object of interaction design and to clarify the contribution it can give to the progress of society.

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[1] In writing these notes I have greatly benefited from the Ivrea Conference on the Foundations of Interaction Design. I tried to take into account all what I have learned during the Conference.

**Interaction costs**

Interaction normally brings benefits to the interacting agents but it may also give rise to costs. Those costs are one of the main reasons why interaction may be only partially effective or may even be lacking.

Over the past few decades economists have been much concerned with transaction costs. These are costs that arise not out of the process of production but in relation to the organization of transactions between individuals. There are various types of these costs and they are not only monetary in nature. They may include the time and effort spent by the transaction parties, typically – but not exclusively - a buyer and a seller transacting in a market. Most of these costs are borne in order to overcome all sorts of information problems.

Interaction costs can be considered a particular type of transaction costs. As with transaction costs in general, some of these arise before interaction takes place: it may be costly to locate potential partners (both as partners in an exchange of goods or services or information) but also time consuming. Sometimes what is required is a comparison of alternative partners and this may not be an easy task at all. Therefore there are costs also in taking decisions. Interaction costs are incurred also in the process of learning how to extract the highest utility from an object that is only partially visible to the consumer.

A good example is what economists call experience goods, i.e. goods the true quality of which becomes visible to the consumer only after a process of learning by using. Time devoted to learn how to best interact with the object is a cost, as is a cost the period that must sometimes elapse before the consumer can get full satisfaction from the object. This is a vivid example of the well-known dictum that time is money. The invisible properties and qualities of the object become visible after a while. An obvious alternative would be a design that made the objects more fully "visible" from the beginning.

All these costs can be seen as obstacles to effective and good interaction. In particular, they can hamper any type of interaction and make the net benefits of interaction much smaller. In the consumption sphere, an example of the former is the decision not to buy too "invisible" an object, while the failure to exploit fully the interactive potentialities of objects is an example of the latter.

Interaction costs have some interesting connections with risk and uncertainty. Indeed, a large part of those costs *arise from* the fact that information and knowledge are far from perfect. Acting under a veil of ignorance on the effects of one's conduct means that we are trapped in a risky situation, where risk means that different outcomes – some positive, other negative – may result form our actions and we do not know for sure, in advance, which one will *materialize*. If you do not know exactly what will happen when you push a button – because the link between that action and its effect is not known or, to use an expression recurrent in the conference, is invisible – then you face a risky situation. Usually individuals do no like bearing risk, they are risk adverse in a precise technical sense.

To reduce risk either you refrain from using the object or you bear the costs necessary to get more refined information. In other words you may not interact at all or you derive a smaller amount of net benefits than possible from interaction. Risk reduction and trust are closely related, even though it is more appropriate to mention trust when

interaction takes place between individuals. Therefore, making interaction more effective implies that trust is stronger. In a network it is easy to connect but not necessarily to interact, precisely because trust is a problem. People may relate to each other but not interact: they do not exchange goods or reciprocally crucial information, they do not share their knowledge and so on.
Interaction can give rise to costs of other types. In particular we can have situations in which the interaction between two individuals – or between an individual and an object – may be extremely positive for them but generates costs to others. You can take great satisfaction from the interaction with your drums but your neighbours' life may worsen quite a lot. These costs are usually called "external" to indicate that they fall on people outside the considered interaction. Despite their importance, in the following pages I will be concerned almost exclusively with "internal" costs. As already mentioned, these costs may cause losses of individual welfare either because they absorb resources or because they prevent the full exploitation of the potentialities of interaction. In the most extreme cases they can block interaction altogether. For example, an object that is very costly to interact with will not be bought and an object that is not bought will no longer be produced. In such a case, in order to stay in the market, a new design capable of making interaction costs markedly lower is necessary .
In more general terms, interaction costs should be a primary concern for interaction design. Effective and workable interaction design should aim at making them as low as possible. This may also include the creation of institutions that act as a connecting element and allow interaction to start. Cost reduction, however, may not be so easy to achieve. Sometimes is may also be advisable not to try to achieve it. These issues will be taken up shortly.

**Are interaction costs increasing?**
An interesting question is whether interaction costs and the effectiveness of interaction have changed, and in which direction, over the past few years. If one could argue that interaction has become more costly or less effective there would be good reasons for investigating why interaction design attracts more interest today. Unfortunately, this is an interesting but extremely difficult question. Our theoretical knowledge is inadequate and we have no good tools for exactly measuring those costs. Moreover, the relevant phenomena are far from uniform and there may be situations where costs have increased and situations where the opposite has occurred. However, let us consider some broad developments and their likely effects on the problem we are concerned with.
Globalisation has made some types of interaction easier while it has much complicated others, when it has not led to their disappearance. The latter category includes the traditional type of social interaction, typical of small communities where the sharing of customs and culture made interaction easier and not risky. Social norms are a very useful lubricant for interaction. They make the world of our relations more visible and other people's behaviour much less unpredictable.
By altering these types of relations, globalisation has probably increased the costs of interaction. This is no to deny that, coupled with technological advances, globalisation has eased other forms of

interaction and led to the diffusion of networks. But, as mentioned, to interact in an effective way is not simply to relate.
Other important developments are, on the one hand, the tendency towards specialization and fragmentation of knowledge and, on the other, the fact that we allow our happiness to depend more and more on rather complex objects. Complexity raises interaction costs also for educated consumers, even though the competence of some consumers may be so high that they become the best advisors of the producer. Fragmentation of knowledge, for its part, may obstruct that combination of the different competences and skills which is often necessary for reducing interaction costs at other levels. Indeed, high interaction costs in the production stage may be one of the causes of high interaction costs in the consumption stage.
Taking all these into account, the guess is that, despite growing networking, the fragmentation of knowledge and social relations and the uneven complexity of objects may have resulted in the substitution of relatively cheap and effective interactions with costlier and relatively ineffective interactions. This may hold for many people, not all, because some may have gained from these developments. But this could be enough to strengthen the demand for better interaction design.
All this is purely tentative and more research is required to put these opinions on a sounder ground. However, the hypothesis that interaction costs have increased for many people is coherent with the idea of some authoritative social scientist[2] that, in our societies, individual risks are much higher because interaction costs and risk are strictly connected.
There are good reasons for arguing that interaction design cannot be divorced from interaction costs. Indeed its primary purpose should be to make interaction costs as low as possible. But here are many difficulties and sometimes it may be better not to try to reduce these costs. Let us see why.

**Interaction costs and the task of interaction design**
Suppose that an agent bears interaction costs that amount to X and gets a given satisfaction from the process. Economists would argue that if the agent is rational he will be ready to pay up to X for any solution that would allow him to save the interaction costs while ensuring the same final satisfaction. As an example, let us consider the learning costs referred to above. If an additional service of any type could allow the consumer to achieve the same results without the loss of time and effort implied by the learning process, the consumer will be ready to pay up to the amount of the saved costs for the additional service. This willingness to pay is proof that a better design has a value, but not an unlimited one. Interaction costs create profit opportunities for firms and, more generally, opportunities for greater social welfare. But these opportunities have an upper limit: the consumer will not be willing to pay more than the amount of the interaction costs he is incurring in the original situation.
As Nobel prize winner Milton Friedman once said, there is no free lunch. Reducing interaction costs is not without costs itself and, if these costs are high enough, the willingness to pay for a "better design" will not elicit a matching supply.

[2] See in particular the writings of U. Beck

Briefly, the point is that the costs to the supplier of a better design should not exceed the interaction costs that the buyer can save.
Having this in mind, we can draw a very important distinction: defective or costly interaction cannot be eliminated, either because it would cost more than the benefits it determines or because some obstacles do not allow it despite the fact that benefits are greater than costs. The two cases are very different. Under the surface of a defective interaction may lie several reasons with different implications for social welfare. In the former case, to ask for better interaction is tantamount to asking for something which costs more than what anybody is ready to pay. Under standard hypotheses of rationality this would imply that the joint welfare of the two parties is not increased. The latter case, on the contrary, is a cause for strong concern precisely because the lack of better interaction determines a loss of social welfare. Let us go a bit further into these differences.

**Interaction costs and social welfare**

Consumers of the same objects differ in many respects. They may face very different interaction costs and they may pursue very different goals in their interaction with the same object. Think, for instance, about the impact of different education and literacy segments. Multiplicity of consumer types raises serious problems.
In general it may be rational on the part of the supplier to choose the solution that fits best the largest number of user needs. Some needs, however, will go unmatched or will be satisfied only if the consumer concerned is willing to undergo a lot of learning in the sense already specified. Here we have a latent demand for better design. Can it be matched in the market? In case this demand remains unsatisfied would this be a serious failure?
To increase the variety of uses of a given object or to make the relevant features flexible enough to support a wider array of user-specific tasks is a costly activity and there is no guarantee that these costs will not exceed the price the market as a whole is willing to pay. The key point here is the willingness of the market as a whole to pay. In fact, since it is impossible to discriminate prices according to use, even those who are satisfied with the current degree of variety should pay more. However, if these consumers resist price increases, the market as a whole can give the thumbs down to the project despite the presence of users ready to pay more. When users have different preferences and different demands for the same object it is almost inevitable that the market leaves some consumers unsatisfied.
Indeed, it is not simply a matter of designers becoming more aware that there is an unsatisfied demand for flexibility and variety. While some consumers would benefit from designing products that support more user goals, the costs of the solution are an obstacle. The solution would be to make price discrimination viable. But it is really hard to implement such a solution. Alternatively, if the neglected user goals are of social relevance in and of themselves, a public authority should take care of the problem, interfering with the market. In conclusion, in this case we do not have a really serious failure of interaction design. Let us now consider different instances.
As to the latter case, we economists know that there are many circumstances under which a transaction that seems to be reciprocally beneficial does not take place. In this case we are in presence of a failure and if the event is being played out in the marketplace the

expression we use is "market failure". There may also be interactions that do not take place (or interactions less satisfactory than possible), even though they might deliver higher benefits than the costs they command. Opportunities for improving social welfare are lost and we would consider this a serious failure.

Mutually beneficial actions are not pursued for various reasons. I shall focus on three of them: opportunism, bad distribution of costs and benefits of better interaction, locked-in consumers.

The distinguishing feature of opportunistic behaviour is the attempt to take an unfair benefit from an advantage that in most cases originates from better or fuller information. Interaction can cause opportunistic behaviour because the supplier and the buyer do not share the same information on the interactive properties of the transacted object. Let us see why. Suppose the buyer attaches to a better designed object a higher value than the cost the producer has to sustain in order to supply it. This means that there are the conditions for a reciprocally beneficial transaction. Suppose, moreover, that the buyer is not able to ascertain immediately the interaction property of the object, as in the case of experience goods. The producer could be tempted by opportunism: he could try to sell as highly interactive an object which is not. If the buyer trusts him he will get higher profits, to the extent that a less interactive object has lower production costs. Knowing this, the buyer will be suspicious and will not trust the supplier when he advertises a highly interactive object. The final outcome may be that only badly designed objects are produced and used. Opportunism and lack of trust are the reasons for this failure.

To overcome this difficulty and win consumers' trust, suppliers should build up a reputation as producers of highly interactive goods. This means that they have to abstain from opportunistic temptations in the short run and rely on the future demand of loyal consumers who, through experience, have come to know that the object really has the advertised features. But in many cases reputation building remedies may not work and failure will not be averted.

A related case is that of switching costs and lock-ins, which are quite common especially in computer markets. Once the consumer has spent a lot of effort and time to learn how to use an object he will not be willing to switch to another object, even though there are good reasons for expecting some benefits from the switch. An excellent example is provided by the effort and time needed to master an operating system. When a large number of consumers is locked-in to the old object, the producers of more interactive goods may reach too limited a market to compensate for the full costs. Lock-ins and switching costs are obstacles to the effective implementation of better design - especially if it is not radically innovative - even though its value to the consumers may well exceed its costs, except for switching costs. It is worth noticing that the higher the effort and time spent in the past (i.e. the less interactive the object were) the stronger this effect may be. Therefore there may be a sort of path dependence in bad design.

The last general reason for the persistence of less-than-optimal interaction design is the distribution of costs and benefits stemming from the improvement. In this case too we can assume that the total benefits of a better design exceed its total costs. However their distribution can be ill-determined in the sense that those who have to bear high costs (or the largest share) will get little benefits. This may

be enough to prevent a social-welfare-enhancing change in design. Situations like this are quite frequent when cooperation among several agents is involved. Suppose that agents with different skills and competences have to cooperate in order to improve the interaction features of an object. The value of this improvement as established by the market is, by assumption, higher than its cost to the full set of cooperating agents. However, the share of benefits for one of them is much higher than his cost while the opposite holds for another. He who gets less than his cost will not participate in this activity and if he is in some sense indispensable, failure will be the sure outcome.

**Conclusions: which foundations for interaction design?**

It has been repeatedly asserted that a lot of interaction design has been made without a theory that helped to understand what was being done and why. This is correct but I would rephrase this sentence in a slightly different way: several activities called interaction design have been carried on lately. What do they have in common that justifies their grouping under the same heading? Theoretical investigation can help us to answer that question, as it points to problems and identifies interpretative categories and tools to tackle those problems. As an economist, this is what I tried to do in these notes..

According to the framework I have sketched above to understand interaction design, one must start from interaction costs. Interaction design is the set of methods and devices that allow interaction to proceed as smoothly and as cheaply as possible. By so doing, interaction design contributes in a very concrete way to social welfare. Investing in ergonomic chairs, to make an example from a closer field, has been welfare enhancing because the costs of ergonomic objects were much lower than the benefits they delivered, also in terms of saved health expenditures. The same should apply to interaction design, in general.

This framework is very broad but not broad enough to encompass all the different meanings that interaction design takes on. Indeed my perspective is somewhat limited, even though I tried to make it as coherent as possible. I believe that there is much to gain from clearly setting the boundaries of interaction design. In this respect, my conclusions are based on the preceding analysis.

First of all, "better" design should not be necessarily considered as interaction design. Nicer objects increase welfare but not through better interaction. I would not include this in interaction design. As a consequence, I would suggest not to link interaction design too closely to marketing, only because its purpose is not to design objects that have or may have a market. In particular, interaction design should not try to persuade or deceive consumers. On the contrary, it must make people's life happier by giving better solutions to real problems.

Second, interaction design is particularly valuable from a social point of view when it delivers benefits that exceed costs and does that by overcoming the obstacles that prevent this result. It is of social value also when it allows the situation of particularly deserving people to improve, even though total benefits may be less than total costs. In this case interaction design can promote social equity.

Third, incentives created by the market may be too weak to carry on all the interaction design that may be valuable for society as a whole. In many cases the most important cause of defective interaction is the weakness of these incentives rather than the simple lack of awareness or the narcissism of the designers.

Fourth, it is sometimes unclear whether interaction design should refer to objects or artefacts rather than to service. The approach in terms of interaction costs highlights that it is not a matter of object or services. On the contrary, the unifying element is the reduction of interaction costs, which in some cases may be the result of a new or improved object and in others of a better organized service. Therefore, those who are engaged in interaction design may be experts in very different disciplines but what makes them part of the same lot is concern for interaction costs. Even though I have not stressed this aspect I believe that organizational issues, as the optimal degree of centralization and decentralization, should be a vital concern for interaction design. From this I would venture to say that, even though they share the same goals, different figures of interaction design experts should be distinguished and forged.

Finally, as I noted, left to its own devices the market may not guarantee the needed type and amount of interaction design. Moreover, in many instances those who suffer from poor interaction are persons who deserve social help and consideration. This poses a crucial and thorny problem: the role of public bodies in supporting interaction design. I leave this problem for the reader to ponder.