Working Paper


Alasdair Rutherford

Department of Economics
University of Stirling
Cottrell 3B91
Stirling
Scotland
FK9 4LA

Tel: +44 (0)1786 467 488
Email: ar34 /at/ stir.ac.uk
Web: acrutherford.blogspot.com

First Draft: May 2008
Current Draft: 15 September 2008

Alasdair Rutherford
Department of Economics
University of Stirling

Ideas about the role of charity in economic theory can be traced back to the origins of modern economics and Adam Smith’s discussion of ‘sympathy’. However, for much of the history of economics the focus of theory on self-interested behaviour has resulted in a separation between charity and altruism not seen in the other social sciences. The more recent flow of ideas from psychology and experimental economics have brought consideration of altruism closer to the mainstream of economic thinking, and economic theories of charity have benefited from a wider approach to the basis of behaviour. This paper argues that a debate sparked by Titmuss’s analysis of the economics of blood donations in the early 1970’s led to a succession of economic theories of charitable behaviour that moved altruism from the fringes to the core of the theory. The depiction of the progress of the theory of charity as a circle highlights the benefits that closer collaboration with other disciplines can produce, especially regarding the fundamental underpinnings of the subject.

Friends, Series 5, Episode 4, 1998

The search for a “selfless good deed” has occupied both philosophers and the writers of American sit-coms for thousands of years. This challenge, and what it might reveal about the underlying motivations of human behaviour, has relevance for many

---

1 Alasdair Rutherford
Department of Economics, University of Stirling, Cottrell 3B91, Stirling, Scotland FK9 4LA
Tel: +44 (0)1786 467 488 Email: ar34 at stir.ac.uk Web: http://acrutherford.blogspot.com
disciplines across the social sciences and further afield. However, despite this common ground separate treatments of the same phenomena abound, and much of the potential gain from the cross-fertilisation of ideas between disciplines is lost.

Altruism and charity seems intertwined and yet within the discipline of economics the initial neglect of a theory of altruism in the face of rational, self interested *homo economicus* means that the history of the economic theory of charity and non-profit organisations was for many years notable for its absence of a treatment of altruistic motives. While the study of altruism can be philosophical in nature, the study of charity considers the application of altruism and its organisational form. Self-interest is to private firms as altruism is to charities. Or is it?

**What is Altruism?**

In order to include altruism in a theory of charity we must first agree what it is and what the term means. At its core, the concept captures a concern for others that is not linked to a concern for oneself. This is however an internal state, and is not directly observable. Can we infer altruism from observing so-called “altruistic” behaviour? A distinction must be drawn between the acts we observe and the internal state, as there can be more than one motivation behind an apparently altruistic act. Being altruistic can create a desire to help others, but the decision to act is taken after considering the constraints faced by the agent (Alchian, 1973). For example, someone with very little wealth might be moved by the plight of those even less well-off than themselves, but is unable to afford to give even the smallest help. However, a rich philanthropist may give substantial amounts without a real concern for those the donation is helping, particularly if such behaviour can increase social standing. If we call gift-giving, or the observed “altruistic” behaviour generosity, then we can see that there is a divide between the act of generosity and the internal state of altruism. This highlights that we must try and explain the observable behaviour in terms of characteristics that are themselves observable.

In this context the word “charity” is used essentially to mean organised altruism, whether donating to a cause or founding an organisation. This means that the focus will be on the theoretical and practical difficulties of coordinating altruistic motives to action in a group setting.

So we have reached a working definition: altruism is caring about other people, and generosity is the act of giving. These are linked, but we accept that other motivations can also drive generosity and so it is not a perfect measure of altruism. It would seem that altruism of this type could be modelled well by a utility function for an agent that takes other people’s wellbeing as an argument. The agent trades-off the utilities of himself and others, within the constraints faced, in order to maximise utility.
However, this formulation conceals another problem with the non-observability of utility – how does the agent know what other people’s utility is? Does the agent consider only utility from the gift being given, or is it assumed that there is knowledge of the precise utility function, and therefore tradeoffs faced, by others? Should we consider higher-order effects, that is, I care about you and you care about me: should I therefore increase my wellbeing motivated by the fact that I know this increases your wellbeing because you care about me? Should we include as generosity my spending money on myself if I do it in the knowledge that it makes you happy? Faced with two unobservable explanations for the same observable behaviour, how can we reach any useful conclusions?

A History of the Economic Theory of Charity

In the Theory of Moral Sentiments (Smith, 1759) Adam Smith considered the implications of a concern for others by suggesting that “sympathy” led individuals to picture the situations of others, and the consequences that actions (including our own) would have for them. Individuals can then incorporate the results of this process into their own decision-making. This permits judgements about the effect of our own behaviour on others to inform our actions. However, economics as a discipline has built its core from the model of behaviour outlined in The Wealth of Nations (Smith, 1784) with the focus on rational self-interest as the base of behaviour.

However, for much of its history a description of altruistic behaviour was considered outside the scope of economics. In The Economics of Charity (Alchian, 1973) Johnson writes:

“Although there is a third, charity, market in which individuals collectively provide public goods without the incentives or penalties of the political market, virtually no research has been directed to it.”

The Economics of Charity (Alchian, 1973), Chapter 5, Page 84

This statement was true when written at the start of the 1970’s, but was followed by over thirty years of increasing interest in the voluntary sector and theories of the economics of charity.

An influential social policy text published in 1970 discussed the role that altruism had to play in economic behaviour, with a specific example in the collection of blood. In The Gift Relationship by Richard Titmuss (1970) the collection of blood donations in the UK and USA were compared, examining the success and failings of a private market in paid blood donations. Economics predicted that the introduction of paid blood donors in the UK would increase the supply of blood. Titmuss suggested that this argument was flawed as it relied solely on a model of rational self-interest, and
ignored the valuable and significant role that altruism plays in many types of transaction.

This paper suggests that the history of theories of charity in economics has been circular, focussing in turn on each of the three motives for action described by Arrow (Phelps & Russell Sage Foundation, 1975) in his response to Titmuss’s book. This path is illustrated in Figure 1 below. Arrow identified three motives for action in utility theory that could lead to seemingly altruistic behaviour:

- **Pure Altruism** – where the utility of one agent directly affects the utility of another
- **Warm Glow** – where an agent derives utility from the act of helping another
- **Social Contract** – where agents utility does not depend on others (i.e. they are self interested), but the cooperative behaviour is efficient if an agreement can be reached that eliminates or reduces free-riding and allows the gains from cooperation to be earned

What Arrow’s analysis shows is that economists were prepared to acknowledge the existence and perhaps even importance of altruism in everyday life. What was not recognised was a role for pure altruism within economic theory, or its validity in explaining phenomenon such as the formation of charitable organisations.

*Figure 1 – Economic Theories of Charity as a Circuit*

Furthermore, these theories advanced as ideas about the validity and use of a pure rational self-interested agent in explaining economic behaviour developed. In particular, evidence gathered by the growing field of experimental economics legitimised discussion of the ways in which behaviour deviating from narrow self-
interest might be modelled. This allowed a growth in the adoption of findings from the disciplines of psychology and sociology to expand our understanding of charity.

Initial theories of the role of nonprofit organisations focussed on the areas that economics was best equipped to tackle using the model of rational self-interest. These explained the existence of charity as an optimal response to the potential efficiency gains of cooperating in a social contract in order to improve society’s welfare within a context of self interest. Ideas of utility gained from the act of “doing good”, separate from the outcome of the act, were then developed. This uses the concept of ‘warm glow’, for example that donors gain utility from making a donation to charity rather than from the outcome that this donation had. It is an attempt to explain seemingly altruistic behaviour that can overcome the free-rider problem. More recently there has been a return to concepts of altruism where utility is gained from the outcome, and where this objective is seen as being separated in some way from a self-interested objective. This means that the debate has gone full circle, as the issues addressed are similar to those sparked off by the discussion in Titmuss’s *The Gift Relationship*. We will now discuss each of these approaches to charity in turn.

**Charity as a Social Contract (1970 – 1980’s)**

There are several explanations of charities that depict them as being the result of a social contract to overcome some market failure. These explanations do not require any description of altruistic behaviour, as they are privately optimal if the appropriate agreements can be reached and enforced. They seek to explain seemingly altruistic behaviour as the result of complex self-interested behaviour.

**Government Failure – Median Voter Model**

One explanation for the existence of charities is “government failure”, defined in a specific way. Given a median voter model of government objectives, the government will provide the levels of public goods preferred by the median voter. This explanation of charitable organisations suggests that voters some distance from the median who would prefer more of a given public good than the median will find it optimal to form a non-profit organisation to provide this additional good themselves, above the government provision. However, this is purely for the benefit of those voters with these preferences, and not as a result of altruism.

Weisbrod (1975) suggests Government failure as an explanation for the formation of nonprofit organisations.

The government is elected by heterogeneous voters, each with different preferences. For a given public good, the government will raise taxes to provide the quantity of the good desired by the median voter. This is shown by point M in Figure 2. If a political party offered to provide a quantity less than the median voter’s level (at A),
then an alternative party could offer to provide the median voter’s level and receive more votes. Providing A would gain votes equal to the dark shaded area, while providing M in competition would gain votes equal to the larger light-shaded area.

![Figure 2 – The Median Voter Model](image)

However, this outcome is not strictly efficient. There are many people who would prefer to pay more tax in order to receive a greater provision of the service. There are also many people who would prefer to pay less tax and receive a lesser provision of the service. If the service is a public good then it is not possible to trade the rights to access the service and the equilibrium will be inefficient.

The choices available to those who desire a lesser provision are limited, save leaving for a different area where their preferences are closer to that of the median voter. However, those who prefer a greater provision have the opportunity to cooperate to organise their own extra provision. Without enforceable tax-raising powers these efforts will be susceptible to free-riders consuming the extra provision of the public good. The smaller scale organisation of a charity could mean that contributors see a sufficiently large effect in provision from their marginal contribution to overcome this problem.

Young (2001) outlines five constraints on government provision that could lead to the formation of charities to extend service provision.

- **Categorical Constraint**
  Government provision tends to be standardised, making it difficult to cater for those preferring small variations in the nature of service provision

- **Majoritarian Constraint**
  The Government must provide the level of service desired by the median voter in order to stay in power

- **Time Horizon Constraint**
  Governments tend to have a shorter term outlook due to political terms, which may restrict their ability to provide services that would benefit society in the longer term
• Knowledge Constraint
  The hierarchy and bureaucracy of government can make it difficult to develop
  new ideas or experiment with new types of service provision

• Size Constraint
  Due to the intimidating size of government it can be difficult for individuals to
  convey their preferences about service provision

This suggests that we would expect to see charities providing specialist variations of
mainstream services, to be taking a longer term view in their service provision, and to
be innovative in their fields.

Weisbrod (1988) advocated government failure as the prime cause of the rise of
charities, and suggested that charitable activity would be greatest in a population that
was more diverse, while a more homogeneous population would prefer government
 provision of services. He suggests that the voluntary sector is necessary in a
democracy to cater for the needs of minorities which the government is unable to help
sufficiently. Furthermore, Weisbrod suggests that this motive for charity operation
explains the observed growth in the voluntary sector. As technological advances
make travel and communication cheaper and easier the members of our societies are
becoming more diverse (Weisbrod, 1997). This growing heterogeneity makes it
harder for governments to cater to minority interests, and increases the number of
charities.

Market Failure Due to Information Asymmetries

A second explanation that is particularly influential in the literature is that charities
can exist to help resolve market failure that results from information asymmetry. If
the seller of a good has private knowledge about quality that it is difficult, costly or
even impossible for the buyer to ascertain then the seller has an incentive to exploit
this asymmetry for private profit. Theorists argue that a non-profit organisation can
overcome this, as removing the profit motive neutralises the incentive to exploit an
asymmetry, and market failure is avoided. While the charity here provides a social
beneficial function, there is no treatment of the altruism that might lead to its
conception, or that might motivate managers to forgo private profits in order to run it.

Many sectors in which charities are common, such as health or social care, exhibit
significant information asymmetries about service quality. The quality of services
provided may only be observable when they are consumed – these are ‘experience
goods’. However, the quality of some services may never be observable, even after
they have been consumed – these are ‘credence goods’.

If quality is difficult, costly, or impossible to measure then this gives the provider
power to exploit the consumers lack of information in order to maximise profits.
Hansmann (1980) suggests that the profit non-distribution constraint means charity managers have little motivation to maximise profits and are unlikely to take advantage of their private information about service quality. This engenders extra trust in consumers, and so helps to overcome the market failure.

Young (1983) suggests that charities pay lower rewards to managers as they don’t make profits, and this leads to screening of managers. Managers seeking high financial awards will tend to favour private firms, whilst managers who gain utility from achieving the objectives of the charity will accept lower compensation to take on the job. This means that managers of charities have an interest in truthfully providing the service in order to maximise their own utility, and this makes charities services more credible.

Bilodeau & Slivinsky (1998) outline a theory of rational nonprofit entrepreneurship, where entrepreneurs wishing to sell a public good must choose between forming a private company or a nonprofit organisation. The willingness of the public to contribute to the public good is greater if the organisation is bound by a non-distribution constraint, as there is less opportunity for the entrepreneur to appropriate contributions rather than providing the public good. If this greater willingness is sufficiently large then it can be optimal even for a self-interested entrepreneur to choose the non-profit form.

Akerlof (1986) describes partial gift exchange as one explanation for labour contracts where workers are paid above the market-clearing wage and firms are rewarded by higher labour productivity even when worker effort is difficult to measure. Akerlof suggests that this gift relationship could be sustained by societal norms of a “fair day’s work”. Although recognising the importance of social or cultural factors these remain exogenous in Akerlof’s model, leaving the partial gift exchange to be an optimal response to a given set of norms.

Charity as Caring About the Means (1980’s - 1990’s)

The main challenge faced in explaining charity is the problem of free-riding. This is a difficulty for both theories based on either social contracts or pure altruism. If an altruist is someone who cares directly about someone else’s utility, then they may feel motivated to give to help that person. However, the altruist gets pleasure from the utility of person B no matter who contributes – if they think that others will contribute then they are rational to free-ride and reduce their donations. To explain the continued donations observed despite this potential problem Andreoni (1990) proposed the concept of ‘warm glow’ giving, where donors derive utility from the means rather than the end. This is used to explain giving to charity where the final recipient is unknown to the donor, the charitable activity is difficult to observe, or is a public good with the potential for significant free-rider problems. However, as observed by Rose-Ackerman (1996) in her survey of the nonprofit literature this leads
to the perverse situation where the only people defined as true altruists by economists are those who care only about ends, not means – and therefore will rationally free-ride on the donations of others, giving nothing.

The concept of ‘warm glow’ can lead to confusion if it is used to describe any utility derived from a charitable act. Andreoni’s proposal for ‘warm glow’ giving included utility only from the means but not the ends as a solution to the problem of free-riding in charitable provision. However, answering the question of “Why do people give money?” with “Because they enjoy it” begs the question “Why do they enjoy it?” Can we really separate analysis of the means from the ends in this way?

Rose-Ackerman (1987) focuses on altruistic motives for supporting a non-profit organisation, and suggests that the “ideological entrepreneurs” who start them are driven by “strong philosophical or professional commitments”. This is a ‘warm glow’ explanation, where entrepreneur gain utility from the charities activities directly rather than from the outcomes. Rose-Ackerman also emphasises the role of the entrepreneurs in deciding the organisations mission, and the challenges that they will face in controlling this mission.

The prestige motivation for charitable contributions and participation emphasises the social gains from being seen to contribute to the public good (Harbaugh, 1998). Prestige provides an intrinsic benefit from involvement with a charity and can overcome the free-riding that would be expected with voluntary contributions to a public good.

More recently, in a theoretical model outlined by Besley & Ghatak (2005) “motivated” agents have a “mission” which they care about, and they gain utility from working with a principal who shares their mission. Agents are prepared to give up some of their pecuniary rewards in return for matching with a principal who shares their mission. The model shows the efficiency gains of matching principals and agents who share a mission as effort is increased. The model makes a clear prediction – that wages in the voluntary sector should be lower due to this “warm glow” accruing to workers in the sector.

**Charity as Caring About the Ends (Late 1990’s – Present)**

Frey (1998) argues that altruistic motivation can not be traded off so easily with financial self-interested incentives. He suggests that the motivation to engage in an activity such as helping others which agents want to do can be “crowded out” by the introduction of payment. Essentiality, the motivation derived from the intrinsic enjoyment of an activity and the motivation from being paid to undertake the activity are separate motivations and are not additive. This leads to the implication that for some activities introducing or increasing payments can actually decrease worker effort. This is a break with traditional “warm glow” explanations which suggested
that the glow produced the same type of utility as payment and these could be traded internally by agents.

McCloskey (2006) argues that self-interest is only one of seven “virtues” which drive human behaviour. These virtues include the classical or pagan four: prudence, temperance, justice, and courage; and the Christian three: faith, hope, and love. She suggests that economics needs to widen its focus from pinning all behaviour on only one motivation (prudence, or rational self interest) and should be prepared to consider the role that the other virtues have as an ethical base to economic behaviour. This would be particularly relevant for the theory of charity, where the virtues of justice, hope and love could certainly be suggested to play a major part.

**The Ends vs. the Means**

Is there such a clear distinction between gaining utility from the means as opposed to the ends? This can be illustrated with an example. There are two agents faced with a decision about whether to donate in support of building a hospital. One is a ‘pure’ altruist who cares only about outcomes, and not about their personal involvement. The second is an ‘impure’ altruist who cares only about their level of contribution to the outcome. Our two altruists are faced with a choice: a hospital built by the donations of others, or a hospital built by the donations of both others and the altruist.

The pure altruist will be indifferent between these two options – only the provision of a hospital matters to them. However, the impure altruist will prefer the hospital that they helped to build. Does this reflect badly on our pure altruist, that they are equally happy having done nothing to help? Consider our second example: a big hospital built by the donations of others, or a small hospital built by donations from both the altruist themselves and others.

The pure altruist will always choose the big hospital – again only the level of provision matters to them. However, for the impure altruist there will be a difference in hospital size where they are indifferent between the two, or even prefer the small hospital that they were involved in supporting, even if this means less overall hospital provision.

So although our “free-riding” pure altruist looks bad in large groups, in a small group they will be the ones building the hospital themselves, while the impure altruist is happy still to contribute the same small amount to a hospital that may never get built. Are we suggesting that individuals must be either ‘pure’ or ‘impure’ altruists, caring only about ends or means? Certainly not, there can be a mix of motivations – but it is important to recognise that there is more than one source of apparently “altruistic” motivation, and that these effects can interact. As we move from studying process utility to examining the utility of outcomes, actually caring about other people, it is
critical that we do not lose the distinction under the tempting banner of “warm glow” utility.

This is not to set charities on a pedestal and suggest that all “charitable” motives are altruistic. Self interested behaviour is certainly a major factor across society and nonprofit organisations are not immune. This suggests that the theories of charity proposed to date are not without use, and highlight some of the motives of some charities. Rather, the argument being made is that this treatment is not sufficient to capture the complexity of this organisational form. Worse still, it neglects the values that lie at the core of this sector.

Of course, this discussion links into a wider debate in economics – the value and use of the self-interest axiom. However, it has implications beyond the philosophical treatment of altruism. A growing “third sector” and an increasing reliance on the independent non-profit organisation in policy implementation means that a theoretical understanding of this organisational form is critical. Can we really form a theory of charity that neglects altruism?

This discussion leaves us with a problem: modelling altruists as caring about other people’s welfare predicts an absence of charity due to free-riding, while explaining charity by modelling donors as receiving utility from the act of giving does not seem to answer the question.

**Self-Interested Altruism?**

Perhaps we should focus on what we can agree on: people are motivated to help others in some circumstances. This motivation can be welfare improving. We can establish through observation circumstances that seem to encourage this motivation (concern for others in need) and circumstances that seem to reduce it (crowding out by financial incentives). Altruism has shown itself to be extremely complicated, with even a formal definition difficult to pin down. This means that it is poorly suited to being incorporated within a model based explicit on its opposite: rational self-interest. However, this does not suggest that it should be ignored in economics – quite the reverse. In circumstances where it would seem to have a significant effect (and there are many) its implications need to enter the analysis whether quantitatively or qualitatively in order to achieve a richer understanding of economic behaviour.

Our contradiction stems from the limitations of trying to represent altruistic motivations in a framework of rational self-interest. The result of this exercise is to exclude any predictions of altruistic behaviour from the model, and thus remove the phenomenon from the sphere of economics. For many applications this simplification causes little problem, and theories based on rational self-interest make useful predictions. However, this has led to a lack of study of the sort of behaviour that
economics does not predict – behaviour which can have real economic consequences. If agents will voluntarily honour contracts due to a sense of duty, resist exploiting greater power through a sense of fairness, or give up resources to others due to sympathy for those less fortunate than themselves, then there is an effect of behaviour which is not self-interested.

This raises the philosophical debate captured succinctly by the character Joey in the American sitcom Friends, quoted in the opening of this paper: is there any such thing as a selfless good deed? Is all our behaviour underpinned by self-interest at its root, with apparent alternate motivations such as duty or altruism merely ultimately self-serving, or do these motivations sit beside self-interest as alternate causes of action, perhaps minor in practice but of equal status? This debate has raged through philosophy for thousands of years, and will not be settled here. This paper is concerned with shedding light on how theories of economic behaviour may be improved in order to be better predictors of behaviour in which self-interest does not play the primary role. That is, if people are behaving as though they are motivated by something other than self-interest, then we will model their behaviour as such.

The Theories of Charity as a Circuit

This discussion has depicted the development of economic theories of charity as a circuit, with the focus returning to the original notions of altruism described by Titmuss in 1970. It is argued that this development is in tandem with developments in other fields of economics, in particular game theory and experimental economics, that brought the discussion of underlying assumptions closer to the mainstream.

Game Theory has expanded the range of behaviour that economics is prepared to model, and increased the complexity with which that behaviour is captured. The growth of Experimental Economics as a method of testing game theoretic predictions, and its subsequent findings, challenge some of the core assumptions about economic behaviour. This has prepared the way for some level of discussion about these assumptions within the mainstream of the discipline.

For example, Frohlich, Oppenheimer, & Moore (2001) writes:

“Traditionally, economists have assumed self-interest governs economic choices. Recently, some social scientists and economists, especially those working in game theoretic and experimental areas, have begun to treat self-interest as a testable hypothesis.”


While there is no suggestion that core assumptions such as rational self-interest are to be abandoned across economics, the interaction of game theory and experimental
economics has created a space in which it is now legitimate in the economic mainstream to discuss these issues. This has helped to break down some of the taboo in economics of incorporating ideas from other disciplines in the social sciences. In particular, insights from psychology have been brought into economic models under the banner of “behavioural economics”.

“Over the years, some prominent researchers in both economics and psychology have criticized some of the tenets of mainstream economics as psychologically unrealistic and proposed alternative assumptions that they believed would improve economic analysis. ... Commonly labeled “behavioral economics”, these efforts to incorporate more realistic notions of human nature into economics have expanded enormously in the last decade. While still controversial, behavioral economics is on the verge of “going mainstream”, especially in top departments in the U.S.”

Rabin (2002), page 657

The development of theories of charities stands as an example of the benefits to a research program of accepting criticism and suggestions from wider disciplines that share research topics.

Conclusion

There is still much to be done in developing economic theories of charity. With the apparent growing importance of the voluntary sector it is perhaps becoming even more important that many of these issues are addressed.

The discussion here is not intended to suggest that the rational self-interested *homo economicus* should be abandoned in favour of *homo sympatha*, or sympathetic man. Titmuss in his original book did not describe even the voluntary community blood donor as purely altruistic:

“No donor type can, of course, be said to be characterized by complete, disinterested, spontaneous altruism. There must be some sense of obligation, approval and interest; some awareness of need and of the purposes of the blood gift; perhaps some organized group rivalry in generosity; some knowledge that fellow-members of the community who are young or old or sick cannot donate, and some expectation and assurance that a return gift may be needed and received at some future time.

The Gift Exchange (Titmuss, 1970), Chapter 5, Page 89

Now that the full range of altruistic motivations can legitimately be discussed in a mainstream economic theory of charity the question that remains to be answered is this:
Can altruism be modelled in the framework of utility maximisation within constraints? Or is an alternative approach required, which does not operate in utilitarian framework, and allows different motives (such as McCloskey's virtues) equal importance in determining actions? This is a familiar problem within economics – this paper has outlined several limitations of the former, but there is yet to be a clear method outlined to proceed with the latter.

Charity is a fundamentally complex phenomenon, and it is right that there are many explanations for its different facets. This paper is intended to depict the development of the economic theory of charity as a journey through the motives underlying behaviour, from a selfinterested starting point to a consideration of the inclusion of explicit altruism. It is also intended to show how a challenge issued from one discipline to another to explain the implications of fundamental assumptions can result in fruitful research culminating in a richer understanding of human behaviour.

References


