AUTONOMY METHOD – ACQUIRING SKILLS FOR ETHICAL ANALYSIS OF COMPUTERISATION IN CAR DRIVING*

Mikael Erlandsson and Iordanis Kavathatzopoulos.

1. Introduction

As a result of the advances made within the field of information technology, many complex and cognitively demanding tools have been introduced into modern transportation. For example, smaller high-speed ferries are equipped with video cameras at the back of the ship to support berthing. The captain then has to integrate several video images into a complete picture of the ship's location, something which can be demanding for someone who already has a high cognitive load [Olsson & Jansson, in press]. Furthermore, modern ship bridges are also being equipped with electronic charts, digital conning displays, more radio communication systems, etc. This technology is introduced with the purpose of aiding the officers on the bridge, but sometimes all this technology put together can work against the captain's goals. For example, if the parallel usage of many systems, on top of the traditional navigation tasks, becomes too cognitively demanding for the driver [Wickens & Hollands, 2000].

Another example is the navigation systems that are getting common in modern cars. By navigation system, we here mean the map based or instruction based digital displays that are based on the global positioning system (GPS). Traditionally, car driving has been concerned with the interaction of such things as gears, brakes, steering wheel, lights, wind shield wipers, etc. However, to experienced drivers, driving is more about observing and interpreting the surroundings, planning ahead, signalling intentions to other vehicles or pedestrians, etc. Drivers of newer cars also have the option of interacting with support systems such as, speed control, navigation system, reverse parking sensor, etc. On top of this, the drivers might also interact with things like sound system, mobile phone, and of course the passengers. Even though, these support systems can provide valuable support, they can also trigger accidents if occupying the driver to much. When the very first navigation systems were introduced in cars, the interaction with them was complicated and demanded much attention especially to enter a new destination [Llaneras & Singer, 2003]. It is ethically questionable if navigation systems with such problems should be let out on the roads. Should the government enforce laws prohibiting or limiting its usage? Should the car manufacturer or the navigation systems manufacturer make efforts to reduce this problem? How should/will the car driver deal with this new tool? No matter where the responsibility lies, someone has to identify that there is a moral problem at hand, and secondly to choose to deal with it or not. An additional problem is that all involved persons or groups in this example are mainly involved for other reasons, for example to cope with technical, financial or marketing problems, than to investigate into ethical aspects. Therefore, the level of ethical awareness is typically low. Furthermore, even if they realize the value of an ethical investigation into this issue, it would be difficult for them since they are probably not experienced. Therefore, it could be valuable to aid the practitioners by providing ethical tools and skills that are suited for them.

* Erlandsson, M. and Kavathatzopoulos, I. (2005). Autonomy method: Acquiring skills for ethichal analysis of computerisation in car driving [CD-ROM]. In G. Collste, S. O. Hansson, S. Rogerson & T. W. Bynum (Eds.), *ETHICOMP 2005: Looking back to the future*. Linköping: Linköping University.

There are many moral aspects to the introduction of new technology, such as car navigation systems, and there are different approaches to deal with these. Lennerfors [2004], who makes a survey of moral aspects concerning the introduction of navigation systems in Swedish taxis, uses ethical theories to argue whether its introduction is morally justified with respect to the privacy of taxi drivers. Here we do not use normative moral theory to argue about what is morally right or wrong, in fact we do not even attempt to find an answer. We only suggest a tool that can aid people, who are not informed about ethical theories, when making decisions related to ethical aspects. This tool can increase the level of ethical competence before a decision is taken, by simply describing all relevant values and aspects for all involved parts in a structured way. By iteratively considering how each possible action or decision affects each possible value for each involved person, company, organisation, etc, a broader and more complex view of the moral dilemma is achieved. The output from this tool works both as a decision support, but also as a kind of documentation for future reference, for continuous dialog and for argumentation reasons. If someone later questions a decision then the documentation can work to explain it, or if additional aspects of the dilemma are revealed then the documentation can be extended with this.

The primary purpose is not to generate answers to particular problems, but rather to acquire a comprehensive view of the problem at hand and also to document the information on which one base the decision making. No matter what the final decision is, this method summarises all aspects considered during the decision-making process. A successful inclusion of moral aspects in car navigation systems analysis, decision making and decision application can easily fail. The cause of this failure may be found in the way thinking, problem solving and decision making are performed by, for example, a car manufacturer. People use different ways to handle moral problems. Psychological theory and research [Kohlberg, 1985; Piaget, 1932] differentiate between two different moral functions, heteronomy and autonomy, which decide a person’s ability to handle moral problems.

Heteronomy is constrained and involve authoritarian thinking. Heteronomous thinking is a purely automatic reflex or it is fixed on one or a few general moral principles, while ignoring other principles relevant to the same problem. With this perspective, decision making is not systematically controlled and follows automatically without reflection. Furthermore, the decision maker’s responsibility is avoided and placed on other persons or on general conditions. Instead of critical and systematic analysis of moral problems, it follows directives of moral authorities, ignores the problem, avoids responsibility, and most importantly that it avoids questions. With this approach, the answers can be made up in advance with reference to opinions and moral authorities. Autonomy, on the other hand, is dominated by asking questions, by a continuous search for missing parts, and of an effort to take control of the situation. Its main emotional characteristics are insecurity and anxiety, which are nevertheless effectively lessened by the confidence on one’s own ability to handle moral issues. Autonomy is a psychological process of ethical problem solving and decision making, which lays the ground for higher ethical competence. The autonomy tool described here uses a matrix in which all alternative ways to treat a moral problem are systematically compared with all values and aspects relevant to anyone affected by it. This matrix effectively describes a more complex picture of the problem. If the autonomy matrix is as a map describing the complete picture, then the heteronomous approach is more like travel directions, only giving limited one-sided information. Autonomy provides a practical tool that can be used, by the participants of system development projects, to examine any ethical aspects that their design might introduce. The inclusiveness of autonomy, based of systematic and critical analysis, promotes one’s own control and responsibility. The process to reach a higher autonomous level does not necessary mean that any conclusion is reached, i.e. an optimal moral solution, but it is a precondition for higher ethical decision making abilities. Thus, autonomy as a psychological skill is a positive characteristic, when facing moral dilemmas.

Technically our approach is similar to other ethical tools suggested previously, for example Paramedic [Collins & Miller, 1992] and Value Sensitive Design (VSD) [Friedman, Kahn and Borning, in press]. However, those approaches do not focus exclusively on what psychological theory and research describe as the basis of competent ethical problem solving and decision making, namely the tension between heteronomous and autonomous moral reasoning [Kohlberg, 1985; Piaget, 1932]. What we need are tools that promote autonomy and hinder heteronomy. Both Paramedic and VSD are excellent tools to systematize, organize and take control of own thinking on concrete moral issues. Nevertheless, since both, in different degrees, urge and lead the extension of thinking to moral philosophical considerations and other details there is a risk of being too complex and of missing the main goal, namely blocking heteronomous thinking. Focus should be on how to handle practical problems rather than on philosophical normative issues. The rest of this paper gives a description how the method was used for the dilemma with the navigation system, followed by concluding remarks concerning the usage of the method [Kavathatzopoulos, 2004; Kavathatzopoulos, Persson & Åborg, 2002].

2. The Autonomy Method

In this study, the autonomy method was performed as follows. Two researchers examined the dilemma of introducing navigation systems in cars. Before the analysis, a few obvious aspects and values of the involved parties were known, as well as the most obvious solutions to the dilemma. These were written down into a matrix (Appendix 1) with values in the row headers and all considered actions in the column headers. While putting this together another solution and a few more values came to mind and these were consequently added to the matrix. This was followed the process of comparing each value/aspect with each solution, which resulted in small descriptions for each cell of the matrix. The small text sum-ups describe how each solution affects each value/aspect. While doing this, even more values and solutions evolved out of the considerations necessary for each cell. Some columns were later merged because of similarity, and others were added. The process of constructing such a matrix can never be completely finished, but the more people involved in the creation the more complete the matrix will become. The matrix in Appendix 1 is the result of a few hours of work made by two researchers from their specific perspective, and one can of course find things to add or modify in this matrix. Indeed, while completing this paper, even more values and solutions came to mind, but these where left out in order to finish the paper at all. Autonomy structures the dialog inside an individual as well as inside or between groups and organizations.

The resulting matrix does not state any right solution, but rather what foreseen effects each solution has to all involved parts. Therefore, to use this matrix as a decision support one has to make a conscious choose between the identified decisions, without being able to ignore all the positive and negative implications that are clearly stated for each decision. For example, if a car manufacturer would have made autonomy analysis similar to the one described in Appendix 1, and later decides to introduce navigation systems in all their new cars. Then, during the decision making, the manufacturer would know the predicted effects of their decision. E.g. the effects on their own sales and status, the navigation system's sales, reputation, job openings, research and development, the car drivers' and the passengers' safety and their use value, and also how the public is affected. If instead a more heteronomous decision would be made without ever trying to explore how different decisions affect different groups of people, companies, organisations, etc, then it is reasonable to expect that only a few of the aspects described above would be considered and maybe also that these aspects are more of opinions rather than expected outcomes. For example, a decision maker at the car manufacturer company might get fixated on the idea to keep up with the latest technology and the idea that this will increase the company's profit. However, because of this fixation other aspects might be unconsciously missed. For example, that the increased accident rates of the car company's vehicles caused by cognitive overload have negative impact on the company's profit and even worse, that people become injured because of these accidents.

It is here worth to make clear that it is always the skills of the people performing the analysis that control the result, and the suggested tool only supports and trains the autonomous thinking. When one is confronted with a challenging problem/situation, one can deal with it either in a heteronomous way, or in a more autonomous way. What the use of the autonomous tool achieves is the blocking of heteronomous thinking by providing a structure for the exhaustive investigation of all relevant ethical aspects in the problem at hand.

Nevertheless, autonomy is not always necessary. Most everyday tasks can be successfully performed with a heteronomous approach. For example, a task like deciding ice cream flavour includes choices that mainly affect oneself, and then a more heteronomous approach can be both useful and efficient. One is then relived of considering all possibilities and can let ones' "feelings" decide. But what happens when you are about to order the last piece of a strawberry flavoured ice cream and you hear a young girl behind happily singing "I'm getting my favourite strawberry ice cream, at last". Then, no matter what you decide to do, consciously or unconsciously you start thinking about other alternatives, and the ordinary task of buying ice cream is moved to a more autonomous level.

There are even situations where autonomy is inappropriate or not even socially acceptable. For example, Goleman describes a man, referred to as Elliot, who had a tumour removed with the result that his pre-frontal lobe got disconnected from the amygdala [Damasio, 1994]. Despite this unusual condition, Elliot's intellect worked as before except that he was not aware of his feelings anymore. Elliot acted like a computer, not being able to assign values to different options in life. In the common task of scheduling an appointment, Elliot laid out good logical arguments against every suggested time even though he had no real problem with any of them. He had no preferences what so ever thereby being completely indecisive, something that is not always acceptable in social situations.

3. Conclusions

The suggested tool does not provide the right answer, but is rather a document used for decision support. Even though this tool can be useful for ethical decisions, it is general enough to be used in any situation where an autonomous approach is favourable. The process of creating and refining the matrix takes both time and effort, compared to more heteronomous approaches. Qualitative analyses of this study indicate that the usage of this method to this particular problem gave a better understanding of the complexity of studied dilemma. Compared to an unstructured analysis, the matrix clearly aided the process of discovering more action possibilities as well as who or what is affected by these actions. However, it is not possible to cover all aspects of a certain dilemma. Because of this, it is also difficult to know when to stop i.e. how much is enough.

This method needs to predict how each action affects the values of each involved party. Many times the outcome of different decisions is not known in advance. This is of course a problem when using this as a decision support, and this problem is not solved in anyway by this method. However, it is still valuable to consider each outcome, and if it happens to be difficult to predict, than at least it is known that there is an uncertainty, as compared to a heteronomous approach where not even this might be known. In addition, after a decision was made and the outcome is known, then the matrix can be updated with this information for future reference.

There is a need for decision makers to learn and understand the idea of autonomy, as well as a need of training and experience in order to apply it in a useful way. It is difficult to know when and where there is a need for an autonomous perspective, that is, to gain a higher level of ethical awareness. It seems that the use of this autonomy tool can heighten the ethical awareness. Furthermore, we have to point out the fact that autonomous reasoning does not guarantee solutions that are morally better, according to certain moral philosophical or simply emotional or subjective criteria.

However, it is not sure that the decision maker wants to acquire an autonomous perspective. Decisions, like the example with the navigation system described in this paper, can be easier if one only focus on the positive aspects for oneself, one’s company or organization. To clearly see the complexity and the effects of one’s decision summed up in a matrix, can be both frustrating and paralysing. No matter what is decided there will be negative effects somewhere, and these will be more evident when making an autonomous decision, as compared to a more heteronomous one. It is of course not only negative aspects that might be overseen with a heteronomous perspective, also the problem space itself become smaller and less close to reality, thereby simplifying the decision process.

Finally, if someone questions the appropriateness of a decision by referring to some aspect relevant to that person, the resulting document from the autonomy method will show either that this aspect was missed during the decision making, or that it was in fact considered together with all other aspects but that the conclusion was another. In either case, the decision maker has the ability to explain, motivate and support the decision made.

4. References

Collins, W. R. and Miller, K. W. (1992). Paramedic ethics for computer professionals. Journal of Systems Software, 17, 23-38.

Damasio, A.R. (1994). Descartes Error - Emotion, Reason and the Human Brain. Gosset/Putnam Press, New York.

Friedman, B., Kahn, P. H. Jr. and Borning, A. (in press). Value sensitive design and information systems. In P. Zhang & D. Galletta (Eds.), Human-computer interaction in management information systems: Foundations. New York: M. E. Sharpe, Inc.

Kavathatzopoulos, I (2004). Making ethical decisions in professional life. In H. Montgomery, R. Lipshitz & B. Brehmer (Eds.) How professionals make decisions (pp. 277-288). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Kavathatzopoulos, I., Persson, J. & Åborg, C. (2002). Individual learning and organizational change for ethical competence in the use of information technology tools. In I. Alvarez, et al. (Eds.) The Transformation of Organisations in the Information Age: Social and Ethical Implications (pp. 383-390). Lisbon: Universidade Lusiada.

Kohlberg, L. (1985). The just community: Approach to moral education in theory and practice. In M. Berkowitz & F. Oser (Eds.), Moral education: Theory and application. (pp.27-87). Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

Lennerfors, T. (2004). GPS –Guard, Pathfinder or Supervisor? An ethical analysis of the global positioning system in the taxi business. (Rep. No. KTH/IFRA/EX--03/036--SE).

Stockholm: Royal Institute of Technology, Department of Infrastructure, Philosophy Unit.
Llaneras, R. E. and Singer, J. P. (2003). In-vehicle navigation systems: Interface characteristics and industry trends. Proceedings of the Second International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design. Iowa City, IA: University of Iowa.
Olsson, E. and Jansson, A. (in press). Work on the bridge – studies of officers on high-speed ferries. Behaviour & Information Technology.
Piaget, J., (1932). The moral judgement of the child. London: Routledge & Kegan Paul (pp.1-103).
Wickens, C. D. and Hollands, J. G. (2000). Engineering psychology and human performance (3rd edn.). Upper Saddle River, NJ: Prentice Hall.

Appendix 1: Example of the matrix resulting from the autonomy method.

		Prevent the system of being used in cars produced by company X.	**Introduce the system in cars produced by company X.**	**Introduce the system in cars produced by company X, with a locking mechanism, that stops the driver from entering new destinations while driving.**	**Introduce the system in cars produced by company X, with regulations concerning its use.**	**Prevent the system of being used in cars produced by company X, until research has shown when and how such tools can be used in a safe way.**
Car manufacturer X	**Status**	Less technically advanced cars. Stronger status in safety issues if media debate, otherwise less changes.	More technologically advanced and expensive cars. Bad/dangerous product can damage reputation. Increased cognitive load on drivers can increase the risk of accidents and damage safety status.	More technologically advanced and expensive cars. Stronger status in safety issues. Increased safety status if driver is prevented from dangerous usage. With the risk of negative effects if the driver manages to use the system, even though being prevented from it.	More technologically advanced and expensive cars. Regulations not effective in practice, which might damage safety status if accidents are contributed to system misuse.	Less technically advanced cars. Stronger status in safety issues if media debate, otherwise less changes.
	Sales	Decreased sales, if competitors advance further.	Increased sales. Higher car prices.	Limited version less favourable, possibly negative effect on car sales. Higher car prices.	Increased sales. Higher car prices.	Decreased sales, if competitors advance further.
Other car manufactures	**Sales**	If Company X prevents usage and they introduce it, they can increase sales. If they do not introduce it, it will be unchanged.	Less technical advances, as compared to company X, can have negative effects on sales. This effect will be avoided if they do as company X.	Less technical advances, as compared to company X, can have negative effects on sales. This effect will be avoided if they do as company X.	Less technical advances, as compared to company X, can have negative effects on sales. This effect will be avoided if they do as company X.	If Company X prevents usage and they introduce it, they can increase sales. If they do not introduce it, it will be unchanged.
	Status	If Company X prevents usage and others introduce it, they can increase their technical status. This effect will be lost if they do as company X.	Other companies fall behind in technical competition if they choose not to introduce a similar solution. This effect will be avoided if they do as company X.	Other companies fall behind in technical competition if they choose not to introduce a similar solution. This effect will be avoided if they do as company X.	Other companies fall behind in technical competition if they choose not to introduce a similar solution. This effect will be avoided if they do as company X.	If Company X prevents usage and they introduce it, they can increase technical status. This effect will be lost if they do as company X.

		Prevent the system of being used in cars produced by company X.	Introduce the system in cars produced by company X.	Introduce the system in cars produced by company X, with a locking mechanism that stops the driver from entering new destinations while driving.	Introduce the system in cars produced by company X, with regulations concerning its use.	Prevent the system of being used in cars produced by company X, until research has shown when and how such tools can be used in a safe way.
Navigation system company	Sales	No products sold.	Products sold.	Products with higher complexity sold for higher price. Fewer sales than without locking mechanism.	Products sold.	No products sold.
	RnD	Decreased development.	Increased development to adapt and sell the product.	Increased research to complement the product with locking mechanism. Increased development to adapt and sell the product.	Increased development to adapt and sell the product.	Increased research. Decreased development.
	# Jobs	Less.	Enough for production.	Enough for production and research.	Enough for production.	Less in production, but more in the research department.
	Reputation	If system is dangerous or unusable, the company's reputation is better off without system introduction. The potential fame of a successful product is lost.	More renown the more products being sold. If system is dangerous or unusable, the company's reputation can be damaged.	More renown the more products being sold. Possibly known for safety-approach, which can have positive or negative effects.	More renown the more products being sold. If system is dangerous or unusable, the company's reputation can be damaged.	If system is dangerous or unusable, the company's reputation is better off without system introduction. The potential fame of a successful product is lost.

		Prevent the system of being used in cars produced by company X.	**Introduce the system in cars produced by company X.**	**Introduce the system in cars produced by company X, with a locking mechanism, that stops the driver from entering new destinations while driving.**	**Introduce the system in cars produced by company X, with regulations concerning its use.**	**Prevent the system of being used in cars produced by company X, until research has shown when and how such tools can be used in a safe way.**
Driver / owner of a car from company X	**Safety**	Unchanged.	Increased cognitive load of the driver can increase risk of accidents. Less risk of getting lost.	Possibly less increase in drivers' cognitive load if passengers are forced to operate the complex tasks of the system. Passengers unused to the system might reverse this effect-	Cognitive load dependent on driver's own abilities and safety attitude, which has safety implications. Less risk of getting lost.	Unchanged.
	Economy	Unchanged.	Increased initial cost. Possibly decreased long term cost if the system finds optimal routes. Increased second hand value.	Increased initial cost. Possibly decreased long term cost if the system finds optimal routes. Increased second hand value.	Increased initial cost. Possibly decreased long term cost if the system finds optimal routes. Increased second hand value.	Unchanged.
	Use value	Unchanged.	Usage of the system supports car navigation, and demands less preparation.	Usage of the system supports car navigation, and demands less preparation. It can be insulting to the drivers to have to stop the car to enter a new destination if they believe they can handle it while driving.	Usage of the system supports car navigation, and demands less preparation.	Unchanged.
	Social status	Less technical status.	Increased technical status.	Increased technical status.	Increased technical status.	Less technical status.

		Prevent the system of being used in cars produced by company X.	**Introduce the system in cars produced by company X.**	**Introduce the system in cars produced by company X, with a locking mechanism that stops the driver from entering new destinations while driving.**	**Introduce the system in cars produced by company X, with regulations concerning its use.**	**Prevent the system of being used in cars produced by company X, until research has shown when and how such tools can be used in a safe way.**
Passengers	**Safety**	Unchanged.	Increased risk of accident if driver uses the system. Less increase in drivers' cognitive load, if the passengers operate the system.	Less risk of accidents when passengers operate the system.	Increased risk of accident if driver uses the system. Less increase in drivers cognitive load, if the passengers operates the system	Unchanged.
	Use value	Unchanged.	Usage of the system supports car navigation, and demands less preparation. Driver or passengers can operate the systems full functionality while driving.	Usage of the system supports car navigation, and demands less preparation. Only passengers can operate the systems full functionality while driving.	Usage of the system supports car navigation, and demands less preparation. Driver or passengers can operate the systems full functionality while driving.	Unchanged.
Public	**Safety**	Unchanged.	Increased risk of accident.	Slightly increased risk of accident.	Increased risk of accident.	Unchanged.