Lovotics

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Lovotics, the Uncanny Valley and the Grand Challenges

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Abstract

Lovotics, the relatively new direction of robotics research, aims to bring love, affection and friendship between the human and the robot. In this paper, we will discuss the key aspects and raise some basic questions, which must be addresses for designing a 'lovotics robot', which is expected to be capable of stimulating mutual love-like bond between the human and the robot. We must also be careful of not falling in the uncanny valley.

Keywords: Lovotics; Socially intelligent robot; Human-robot interaction

Introduction

Lovotics is an emerging concept expected to bring love, an affection and friendship in human and robot relationship [1,2] therefore taking human-robot interaction towards emotionally engaging robots. The key aspects, which make such robots different from a toy is, autonomy and cognition, inspired by multidisciplinary aspects of robotics, artificial intelligence, philosophy, psychology, biology, anthropology, neuroscience, social science, computer science and engineering. Therefore, in addition to the common research challenges associated with social robotics [3,4] and human robot interaction [5], there are issues associated with the 'Love' aspect of such robots, both in terms of how to measure that, and how to get that embodied during the design process [6,7]. One of the important aspects is not to forget the trap of the uncanny valley in such measures and design process [8]. Because Lovotics adds another dimension of emotional anthropomorphism in the robot, which coupled with the human-like physical design and movement might lead towards the negative response by the human, hence, the robot might fall into the valley. Therefore, the precaution must be taken to ensure the long term 'acceptance' and 'success' of such robots, which is termed as Lovotics robot.

The Design Challenges

The design process of such Lovotics robots highlights the following aspects [1]:

"For Lovotics, there is a need for it to encourage sociability with human being and thus its appearance is key as well as its tactile, audio and visual input and output". Hence, the robot's body design is important.

"For Lovotics, the meaning will be to create a robot that loves the user and evoke feelings of love from him/her" Hence, the robot is supposed to touch the user emotionally.

"For Lovotics, its main aim is to infer sociability with humans through love with interactions that are comprehensible and intuitive". Hence, the robot should behave in a human understandable manner, i.e. the human should not be on the compromising or surprising side while interacting with the robot.

"The Lovotics robots need to immediately give the message to the user of its function and purpose". Hence, the benefits from the robot should be easily perceivable.

The discussion above suggests that a Lovotics robot will be supposed to 'touch' the people emotionally by its behaviour and appearance. This requires a careful thinking about how deeply and how much in a humanlike manner it should 'touch'. Otherwise it might fall in the uncanny valley [8], where it will serve exactly the opposite the purpose a Lovotics robot is built for. In [7], it has been proposed that to avoid the uncanny valley a simplified representations of characters for the robot might be more suitable. However, here, it is important to note that we have to think about the uncanny valley not only in terms of resemblance in the look of the robot but also in the behaviour and intelligence of the robot. As adding movement amplifies the valley, therefore the emotional aspects of Lovotics can further contribute to the uncanny valley. As a Lovotics robot will be supposed to be sociable and one aspect is showing social intelligence. Further, a socially intelligent robot is supposed to show human style intelligence [9,3]. This incorporates the aspects of humanlike emotions and cognitive reasoning. Further, the learning, which is the basis for child development, is already getting incorporated in Lovotics robots. If we expect to develop the bond of love and friendship with a machine, the challenge is to identify the constituting attributes and the come up with a correct approach to develop such robots. If we keep the very basic aspect of safety and the concern related to ethics away from the discussion, even then there arises a list of concerns, which we must address in designing a

Lovotics robot:

Developmental or Implanted Love: Should the Lovotics robot grow and learn to love and be lovable in the way a child develops, or this will be the developer of such robots, who will pre-equip such robots with some 'selected' aspects of love and affection? Do people feel more attached to such robots when it will grow like a day one child or we should accelerate the developmental process of such robots by equipping them with the basic building blocks of socio-cognitive intelligence [10], so that it can develop more complex behaviours through learning?

Level of Social Satisfaction: Recent preliminary studies, such as [11], suggest that greater the perceived benefit from the robot by the human, greater will be the level of satisfaction of the human in the relationship with the robot, and they even trust the robot more. The underlying aspect is the embodiment of the social presence and the level of social satisfaction. If we consider care and trust as the attributes for Lovotics, then will it be sufficient for the robot to be a caretaker, or will in the long term the human's social desire to take care of his/her social (robot) partner emerge? Then, should the Lovotics robot only be perceived as someone who cares or should also be deliberately and properly respond to "care-giving thirst" of the human, as being someone who needs care? Will this make the bond of love stronger?

Cuteness vs. Behaviour: How complex behaviour of the robot is sufficient to be loved? Do we expect the robot to love by its 'cuteness' coupled with some basic movements or the robot should show some expected behaviors at some important moments? Are such robots supposed to be showing childlike artificial curiosity and intrinsic motivation [12] or just facial emotions [13] will be sufficient to be lovable and to show love?

Predictiveness of Behaviour: Will the robot be predictable about its behaviour or it should behave dynamically? In other words, does the expected 'touch' of love should be fulfilled by behaving in a predictive manner, repetitive in similar situation or there should be enough variations in the behaviors, to be beyond being predictive and giving the impression of repetitive? How to achieve that variation is a different question, which can either be synthesized by the robot or could even be randomly selected from a large database.

Active, Reactive or Proactive: Should the Lovotics robot be equipped with actions just showing some carefully embedded activities, or it should be equipped with capabilities to show reactive responses as well? Moreover, should it be behaving proactively? For example, proactively coming closer to the human when he/she is sitting alone. Research suggests that proactive behaviour of the robot reduces the confusion of the human and turns out to be one of the important aspect of making the user more attached to the robot as the users find that the robot is more 'supportive' and 'aware' about them, [14].

Extent of communication: How much the Lovotics robot should communicate with the human partner and what should be mode of communication? What should be the proper balance of speech and body language, which not only serve the core purpose to interact but also stimulate the formation of the bond of love and friendship?

Level of Autonomy: What should be the level of autonomy of such robots? Where should it fall on the scale of being completely autonomous to being teleoperated?

Role: Will such robot be sitting in between two humans as a multi-modal messenger or it will have its own existence? Will its presence be a substitute, supplement or complement for the desire of love and friendship?

What to tell and whom to push: Do we need to push people to love the Lovotics robots or need to push the robots to be lovable by the people? Related to this is, do we have to tell the human user explicitly that the robot does not have 'real' emotion, or is not completely autonomous? Or do we have to let the user develop a personal belief about such aspects?

Cultural Sensitivity: The attitude towards robots varies across cultures [15,16]. On the other hand, as we begin to love newborn children without the children being aware about the culture. Then the question arises, how sensitive the robot should be in terms of cultural resemblance in its behaviour and appearance? Should such robots be showing cultural aspects or should always be at a level of behaviour, which does not touch the distinguishing boundaries of cultures?

Target user: Who will be the end user of a particular Lovotics robot, a child, a disabled person, a person needing therapy, or someone else?

While designing a Lovotics robot, we have to carefully decide about all these aspects and the specific requirements, while keeping in mind that some combinations of the attributes of the robot can push it on the either sides of the uncanny valley or can fetch it into the valley. Further, depending upon the needs, we can end up with different types of Lovotics robots, which is completely acceptable.

Practical Development and Applications

On the application side, a Lovotics robot can have a blend of societal application, ranging from entertainment to health care and therapy. Various collaborative research efforts all around the world are focusing on some or the other aspects of harmonizing the human-robot coexistence and creating a kind of bond between the human and the robot. The Lovotics robot shown in Figure1a and the robots developed by Aldebaran Robotics (Nao, Figure 1b and Romeo, Figure 1c) are some of the robots, which can potentially develop the relation of love and friendship with the human. In one of the leading and ambitious research project Romeo2 (Humanoid Robot Assistant and Companion for Everyday Life) 1, the robot is expected to assist and support the elderly and person under medical supervision, in his/her day-to-day live. The robot will incorporate some of the basic ingredients of being a caring agent of the cohabitants. The project has the ambition that the robot will not only serve the human, but also to develop emotional bond and attachment between the robot and the person the robot is taking care of. Such projects show the importance of Lovotics a branch of robotics research worth investigating and investing.

Conclusion

We have tried to shed some light on the field of Lovotics, which is an emerging field of robotics research, incorporating multidisciplinary aspects. We have argued that as such robots are supposed to be equipped.

1Romeo2 project is funded by BPI France in the framework of the Structuring Projects of Competitiveness Clusters (PSPC).

With another dimension of anthropomorphism, bond of emotion and love, they might fall in the uncanny valley if proper attention is not paid in the different aspects of the design process. Such aspects are ranging from the appearance to the behaviour and intelligence. We have outlined some of the key questions, which we must answer when talking about future Lovotics robots for long term coexistence with the human.

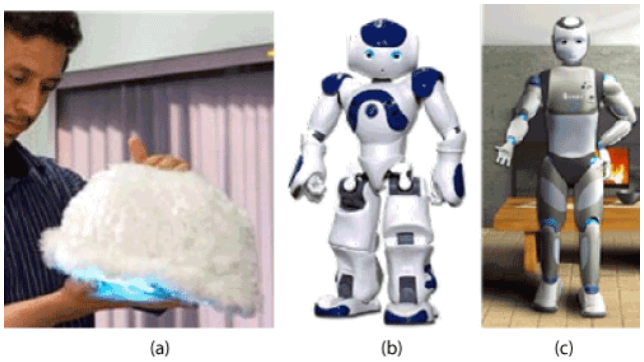

Figure 1: (a): A Lovotics robot (source: http://www.lovotics.com/), (b) Nao robot, (c) Romeo robot, are some of the robots, which could be potentially used to develop the emotional engagement and the bond of love and friendship, based on their appearance, capabilities and behaviour.

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