Using chatbots against voice spam: Analyzing Lenny's effectiveness

Merve Sahin, *EURECOM, Monaco Digital Security Agency;*
Marc Relieu, *I3-SES, CNRS, Télécom ParisTech;* **Aurélien Francillon,** *EURECOM*

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Merve Sahin
EURECOM, Monaco Digital
Security Agency
Sophia Antipolis, France
merve.sahin@eurecom.fr

Marc Relieu
I3-SES, CNRS,
Télécom ParisTech
Sophia Antipolis, France
marc.relieu@telecom-
paristech.fr

Aurélien Francillon
EURECOM
Sophia Antipolis, France
aurelien.francillon@eurecom.fr

ABSTRACT

A new countermeasure recently appeared to fight back against unwanted phone calls (such as, telemarketing, survey or scam calls), which consists in connecting back the telemarketer with a phone bot ("robocallee") which mimics a real persona. *Lenny* is such a bot (a computer program) which plays a set of pre-recorded voice messages to interact with the spammers. Although not based on any sophisticated artificial intelligence, Lenny is surprisingly effective in keeping the conversation going for tens of minutes. Moreover, it is clearly recognized as a bot in only 5% of the calls recorded in our dataset. In this paper, we try to understand why Lenny is so successful in dealing with spam calls. To this end, we analyze the recorded conversations of Lenny with various types of spammers. Among 487 publicly available call recordings, we select 200 calls and transcribe them using a commercial service. With this dataset, we first explore the spam ecosystem captured by this chatbot, presenting several statistics on Lenny's interaction with spammers. Then, we use conversation analysis to understand how Lenny is adjusted with the sequential context of such spam calls, keeping a natural flow of conversation. Finally, we discuss a range of research and design issues to gain a better understanding of chatbot conversations and to improve their efficiency.

1. INTRODUCTION

Unwanted phone calls have been a major burden on the users of telephony networks. These calls are often not legitimate (e.g., generated without the consent of the callee) and can be very disturbing for users as they require immediate attention. In the USA, the Federal Trade Commission (FTC) has received over 5 million complaints about such unwanted or fraudulent calls in 2016 [31]. Moreover in 2015, 75% of generic fraud-related complaints reported telephone as the initial method of contact, which raised from 20% in 2010 [29].

The interconnection of IP and telephony networks facilitates

voice spam, as it significantly reduces the cost of calls. Voice spam can be performed in many ways, but a common way is to use an auto-dialer equipment to generate vast number of calls to a given (or randomly chosen) list of phone numbers. Once a call is answered, either a pre-recorded message is played (which is called a *robocall*), or the callee is assigned to a live human agent for further interaction. More intelligent auto-dialer equipment (e.g., predictive dialers) can increase efficiency of call-agent scheduling and also check if the call is answered by a person or an answering machine (such as voicemail) [12]. The spam campaigns are often performed by call centers that may belong to legitimate companies, as well as illegitimate organizations.

While the robocalls can be very cheap and very easily disseminated, employing call center agents is often a more costly operation. A 1-minute robocall costs around 4 cents per dial[1], whereas servicing a customer at a call center can cost around 50 cents to $1 per minute [13,70]. It is also common to utilize overseas call centers (e.g., call centers in India or Philippines [45]), to take advantage of cheap labor. Such call centers still cost around 15-20 cents per minute for outgoing calls [16]. On the other hand, interaction with a live human agent is likely to make the spam campaigns more efficient. In fact, among the 5 million complaints received by FTC, 64% were recorded calls (robocalls) [31], which means the remaining 36% involved human agents. Usually, the number of call center agents are much lower than the number of calls that can be generated by the auto-dialer equipments. As a result, human agents may not have time to answer all the connected calls. Thus, human agents become a limiting factor for fraudsters, whereas the actual cost of generating the call is nearly negligible.

Fighting voice spam is challenging for various reasons. Fraudsters may spoof or block the caller identification (caller ID) information, which makes their identification more difficult. Overseas fraudsters make law enforcement even harder. In many countries, regulators offer consumers to register the *do not call lists* to reduce the number of unwanted calls. However, efficiency of these lists are questionable, as the illegitimate parties do not follow these lists anyway. For instance, the do not call registry in the USA still receives millions of complaints [31]. Moreover, a recent survey shows that 82% of participants did not notice a significant decrease in number of calls after registering to the national do not call

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[1] http://www.robocent.com/, http://www.robodial.org/instantpricequote/

list [24]. In fact, some forms of calls (such as calls from charities and political organizations) may be exempt from abiding by the do not call lists [32]. In addition, suing telemarketers can be time consuming and costly [6]. Even though important progress has been made on identifying and blocking robocalls (such as mobile applications [18,26], call audio analysis technologies [17], government efforts [28,30]), voice spam remains an open problem.

On the other hand, individuals have been developing their own methods to fight these calls. Many videos where the people are teasing with or scamming back telemarketers and other phone scammers can be found online [4]. Moreover, there exists various recommendations on how to annoy telemarketers and waste their time [2,33]. Due to the cost of human labor, wasting time of one telemarketer leads to a waste of money for the call center, and also saves other people from falling victims to voice spam. For telemarketers, time is money, because each new call they make increases their chance to reach another customer and make profit [3, 47]. However, these individual efforts to stall telemarketers require the callee to waste his time talking to the telemarketer as well.

In this paper, we study an automated way of wasting fraudsters' time and resources (while, at the same time, annoy them). This method employs a chatbot which will act like a legitimate callee and interact with the fraudsters. *Lenny*, to the best of our knowledge, was the first chatbot to become popular for this purpose. It consists of a set of pre-recorded sound files that are played in a specific order to engage in a conversation with a phone spammer.

Although there is no indisputable evidence of this chatbot's origins, some information can be found online. Lenny has been reported to be a recording performed for a specific company who wanted to answer telemarketing calls politely [9]. Later, the recordings were modified to suit residential calls [23]. Moreover, Lenny was inspired from *Asty-Crapper* [7], which was an earlier version of such chatbots, but has not found extensive use. Note that Lenny was not recorded by a professional actor; the voice and age patterns were acted (faked) by a person using his own local accent [9].

Lenny is interesting to study, because it is incredibly realistic and is able to trick many people even without any artificial intelligence or speech recognition mechanism involved. We claim that this success relies on the conversational quality of the recordings. In this paper, we will examine how Lenny is able to stall fraudsters (even up to 1 hour [11]) and discuss the effectiveness of such chatbots to fight voice spam.

Currently, Lenny is provided as a free and open service that allows people to transfer their incoming unwanted calls, using a *warm transfer* or call forwarding.

An important aspect of such chatbots is the usability of the call transfer methods from phone user's perspective (we briefly discuss this in Section 6). However, in this paper, we instead treat the chatbot as a human computer interface and we study the usability of the chatbot in the specific, sequential context of spam calls. Because Lenny's turns fit very well into the conversation, despite being scripted recordings, Lenny has good "usability" as a conversation partner in spam calls. The better its usability, the longer time the caller will waste on the phone, consequently damaging the spam campaign and protecting real users.

We rely our analysis on the call recordings that are available at the public Youtube channel [15]. We select 200 videos from this channel (corresponding to 2,000 minutes of calls) and examine the transcriptions of these calls. We also analyze more than 19,000 call data records (including call date, time and duration) collected by this phone system in the last 1.5 years. Our aim is to shed light on various types of spam calls, different strategies employed by spammers, and also to analyze the conversational properties of these calls to better understand the effect and efficiency of this chatbot.

In summary, in this paper, we make the following contributions:

- We make the first study analyzing a chatbot, which also acts like a high interaction honeypot, to fight voice spam. We observe the different types of spam calls, and evaluate spammers' strategies and interactions with this chatbot.

- We explore the reasons behind the success of this chatbot from an applied conversation analysis perspective.

- Finally, we discuss the challenges in the widespread use of such chatbots and a series of research and design issues.

2. BACKGROUND AND RELATED WORK
In this section we review related work, first on voice spam, then on chatbots and finally on conversation analysis.

2.1 Voice Spam
Voice spam can take many forms and it has been widely studied in the literature. Some studies aim to explore the telephone spam landscape, and better understand the spammers' techniques. A technique frequently used for this purpose is telephony honeypots. A telephony honeypot is a set of phone numbers used to receive spam calls which are received by an automated system (e.g., a VoIP PABX such as Asterisk) and can be interactive (responding to the call and interacting with the caller) or low interaction (not responding to the calls) [35]. Gupta et al., uses a telephony honeypot to analyze 1.3 million calls in a low interaction honeypot [36]. [51] analyzes data from another honeypot that receives robocalls and record the incoming audio. By using certain audio features [20], authors shows that it is possible to identify the infrastructure and the distinct actors behind spam campaigns. Authors find that 51% of robocalls were initiated from 38 different infrastructures [50].

Miramirkhani et al. [54] takes a different approach and studies technical support scams. Authors identify websites advertising scam phone numbers and call 60 of these numbers to interact with the real scammers. They also analyze scammer demeanor (finding that they are usually polite) and the social engineering techniques used by scammers (such as showing various warnings to convince a computer is compromised). Another approach studied in [67] is to look at the linguistic properties of IRS scam calls posted online. This study aims to understand how forensic linguistics may help in the identification of social engineering attempts.

Tu et al. [69] surveys the existing unwanted call prevention techniques and presents an evaluation criteria to assess

these. In fact [69] shows that none of the techniques are perfect. While use of chatbots may not be counted as a real spam prevention method, it might be useful to reduce unwanted calls, as it would damage the financial benefits of spammers [61].

2.2 Chatbots

Bots have been built as personas (an artificial but realistic identity) who produce a recognizable type of conduct from the members of such categories (for ex. an "old guy"). Since ELIZA [73], chat bots associate a recognizable identity with a specific ability to produce some linguistic contribution (for instance, turns at talk).

Today, advanced artificial intelligence techniques enable intelligent chatbots, used as personal assistants on smartphones (e.g., Cortana, Siri), application communications (e.g., banking [19]), even as a friend [71]. There are industry efforts to build better and more intelligent chatbots [1,49]. While such advanced chatbots are generally not publicly available, they often have a synthetic voice which is distinguishable from a real human voice. However, it can be expected that such chatbots will keep on improving.

Lenny is not the only chatbot used to fight telemarketers. For example JollyRoger [14] is another similar, but paid, service that hosts multiple chatbots with different personas. However, to the best of our knowledge, Lenny was the first freely available chatbot with a significantly large and public dataset.

2.3 Background on Conversation Analysis

Conversation Analysis (CA) is a sociological perspective which aims at studying the organization of natural talk in interactional order to uncover the seen but unnoticed [34] methodical apparatus which speakers and recipients use in order to solve the basic organizational issues they deal with while talking. Trying to show how the participants to a conversational exchange orient themselves on those methods, CA adopts a descriptive stance, deeply rooted into the detailed analysis of recorded conversational exchanges. Four main apparatus have been isolated and explained, which correspond to four major organizational problems that speakers have to solve.

The first range of issues comes from the management of speakership and hearership between the participants to a conversational exchange. In their famous paper, Sacks et al. [59], present the *turn-taking apparatus*, a model of the methods used to minimize gaps and overlaps while distributing turns in conversation.

In a second classic paper [65], the authors isolate a second pervasive conversational practical problem that speakers tend to solve: *the trouble management issue.* This second apparatus provides a model to explain how speakers repair any trouble in hearing, understanding, or speaking.

The third apparatus deals with the *sequential organizations of actions in talk exchanges*, which we will be using along this paper and therefore deserves a more detailed presentation. Conversationalists assemble their turns in sequences of action which go together. A sequence is an "ordered series of turns through which participants accomplish and coordinate an interactional activity" [53]. A common type of sequence,

composed with two interrelated turns has been called an adjacency pair [60, 62, 64]. Question → answer, greetings exchanges, offers → acceptance/rejection or request → acceptance/rejection share many properties of adjacency pairs. Indeed, they consist of two utterances, a first part and a second part (the order), produced by different speakers with an adjacent positioning (contiguous) [60]. The first and second parts fit into specific types, for example, question and answer, or greeting and greeting. The form and content of the second part depends on the type of the first part. Given that a speaker has produced a first part, the second part is relevant and expected as the next utterance. Adjacency pairs share a normative property: Once a first pair part is uttered it becomes conditionally relevant that the other participant should produce the relevant second pair part. In other words, adjacency pairs point to the normative expectations that are embedded into the ways we order turns at talk as pairs.

The fourth apparatus aims at *clarifying how speakers use membership categories during talk exchanges.* [57] and [58] discussed how conversationalists use categories to recognize, identify, describe or infer about people. This range of topics have been explored in a sub CA area called "Membership Categorization Analysis" (MCA [42,44]). Identities, such as "elderly", can be displayed within and through the sequential organization of talk, without being explicitly referred to. Most CA studies have demonstrated how categories and identities are made demonstrably relevant by the participants themselves in the detail of their talk.

3. DATA COLLECTION & METHODOLOGY

Telephony honeypots commonly use large sets of unused phone numbers, such as new (previously not allocated) phone numbers or, better, numbers which have been returned by users who receive too much spam. Such phone numbers are then directed to an IP-PBX (IP based Private Branch Exchange). An IP-PBX uses a set of phone lines to receive calls and allows to process (e.g., answer, record, forward) these calls. Low interaction honeypots will let ring the call or hangup and record the call metadata. In addition to this, a high interaction honeypot will answer the call and interact with the caller. A difficulty for setting up high interaction honeypots is that in many countries recording the call requires both caller and callee agreement, otherwise, recording without agreement could be considered as illegal wiretapping. Asking for permission would however change caller behavior or raise suspicion. Indeed, as it is uncommon for callees to request permission to record this would bias the study. The recordings we used in this paper were all conducted in a country and under conditions which make those recordings legal.[2]

3.1 Lenny's Interactive Voice Response (IVR) System

Lenny's voice recording are publicly available, and our study focuses on one particular deployment which made audio recordings available and attracted a significant amount of interest [8, 22].

In Lenny's particular implementation (Figure 1), incoming phone calls are answered and the set of audio recordings are

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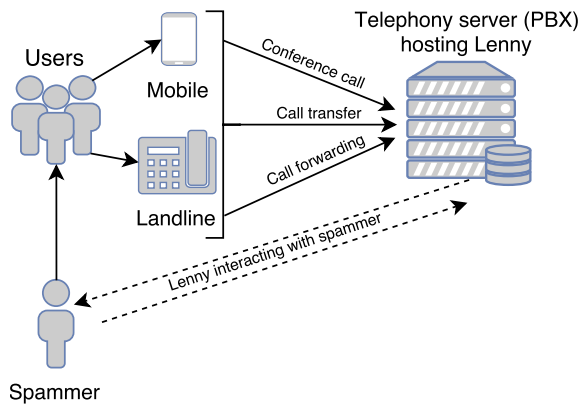[2]We omit details to preserve the anonymity of the PBX maintainer.

Figure 1: Deployment setup and usage.

played one after another, to interact with the caller. There is no speech recognition or artificial intelligence to select or modify Lenny's answers, the same set of prompts is always used in the same order. This is controlled by an Interactive Voice Response (IVR) script which allows simple scripting and detection of silences.

The script starts with a simple "Hello, this is Lenny." and will wait for the caller to take his turn. If he does not respond within 7 seconds, the server switches to a set of "Hello?" playbacks until the caller takes his turn. However, if the caller speaks, the IVR script waits until he finishes his turn. The script detects the end of the caller's turn by detecting a 1.55 second long silence period, at this point it will play the next recording. When the 16 distinct turns that are available have been played, it returns to the 5th turn (the 4 first prompts are supposed to be introductory adjacency pairs) and continues playing those 12 turns sequentially, forever.

The PBX server hosting Lenny is reachable both via a SIP URI and via a landline number. Some common methods to transfer a call to Lenny are (Figure 1):

- When a phone user identifies a spam call, he asks the spammer to hold on for a second, then either transfers the call to the phone number of the PBX server or creates a 3-way conference call, and lets Lenny interact with the spammer.[3] In this case, the caller ID logged on the PBX server will belong to the phone user.

- A user can directly forward previously known (black-listed) spam numbers to Lenny. In this case, Lenny will be the first respondent of the call, and the PBX server will log the spammer's caller ID.

It is estimated that around 500 users are using this service, as the calls are targeted to real users they sometimes contain private data, such private data is curated before the calls are made public.

3.2 Public Dataset and Selection

We use data collected by a popular deployment of Lenny for which a set of call recordings are available online on

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[3]In a conference call, the user can mute his phone and does not need to interact.

Youtube [5]. As of November 14th, 2016, the Youtube channel contains 487 unsolicited calls answered by Lenny, with an average call duration of 09:43 minutes. In addition to this, we obtained the PBX server call logs (call date, time and duration) for 19,402 spam calls sent to Lenny over 18 months (from 06/17/2015 to 12/17/2017).

Among the 487 public call logs, we select 200 calls randomly, but preserving the call durations distribution (Figure 2). We also include some interesting outliers, like a 1-hour call.

We then used a commercial transcription service to facilitate the analysis of the call recordings. Over 2000 minutes of Lenny calls were transcribed with verbatim transcription and timing of each turn of the conversation. We chose a professional transcription service over a speech recognition tool (like in [51]) in order to obtain the high transcription accuracy required for conversation analysis. Finally, we converted selected fragments of transcripts to the Jeffersonian transcription notation [46] required for very fine grained analysis.

3.3 Limitations of the Dataset

While this dataset is relatively large and instructive on the discussions between abusive telemarketers and Lenny, it comes with a few limitations.

First, the audio recordings publicly available on Youtube were selected by the owner of the PBX server subjectively, with a changing criteria over 3 years.

Second, the call recordings are not always complete, they only contain the part of the call that is handled by Lenny (after it has been transferred) and some parts have been edited to remove personal information.

Finally, the IP-PBX does not always receive the caller ID information of the spammer, but the caller ID of the user transferring the call. As a result, it is not possible to precisely know the spammers' caller IDs and to use this in our analysis. Moreover, a user may arbitrarily transfer only a subset of the spam calls he receives, so the coverage is limited compared to the other honeypots which do not require a human to transfer the call [36, 51].

Nevertheless, this dataset is very interesting to understand and analyze the audio conversations between a telemarketer and an automated system.

4. ANALYZING THE SPAM LANDSCAPE

In this section we will analyze the voice spam landscape, comparing our observations with previous work. We will also analyze how call agents behave and how their behavior vary according to the type of the spam call.

4.1 Observations on Call Logs

We observe several trends on the spam calls, using the 18-months dataset of 19,402 calls. Figure 3 shows how the calls are distributed over the days of a week and hours of a day. Majority of the calls were made on weekdays and business hours, which is in line with the findings in [36].

Figure 4 shows the distribution of the call durations (in minutes). In particular, 78% of the calls were less than 2-minutes long. On closer inspection, many of those short duration calls were due to call forwarding problems. In other, more frequent cases "abandoned" calls were dialed by a pre-
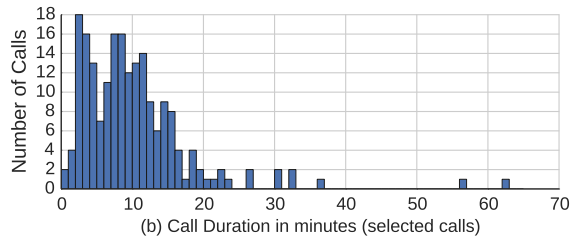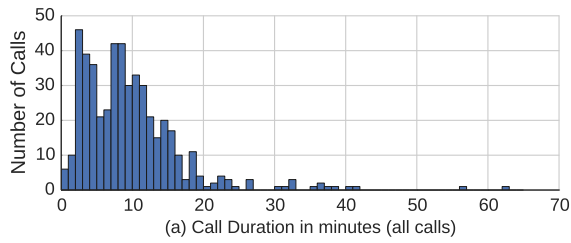
Figure 2: Histogram of call durations uploaded on Youtube channel, (a) all calls as of November 14th, (b) selected calls.
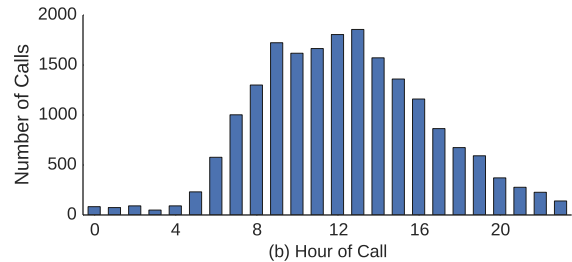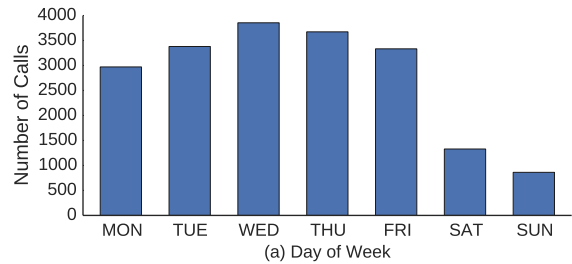

Figure 3: Histogram of calls by (a) days of a week and (b) hours of a day. Note that time zone of callee might be different from time zone of the PBX server in some cases.
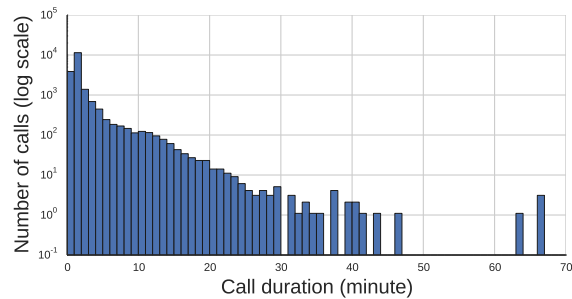

Figure 4: Histogram of call durations covering 18 months.

dictive dialer, but were not transferred to a human agent afterwards, or dropped by the caller. Unfortunately, we did not have access to all recordings of such calls and we therefore do not have detailed measurements on this aspect. We assume that the calls longer than 2 minutes contain real conversations of spammers with Lenny. Considering the 4094 calls that are longer than 2 minutes, we find that Lenny stalled spammers for more than 385 hours in 18 months, with an average call duration of 5.6 minutes.

Due to privacy concerns, the PBX logs we obtain do not contain any caller IDs. Moreover, as explained in Section 3.1, caller IDs received by the PBX may belong to the spammers, and may be spoofed. Therefore, we cannot present statistics on the increase or decrease of spam calls experienced by individual users over time. However, we present the monthly distribution of calls in Figure 5. Note that the increase in calls may result from the increase in the popularity of the PBX server among the online community.

4.2 Analysis of Call Recordings

Transcriptions of call recordings provide valuable insights on different types of unsolicited calls the customers experience, and the strategies frequently used by fraudsters to convince customers.

Initially, we isolate the spammers' turns in each transcript, tokenize the words and use k-means clustering algorithm (with k=15) to cluster the spam calls. Then, we manually examine the results and end up with 22 clusters. Upon further examination, we create a broader classification of spam types: fundraising, telemarketing (targeting home owners, business owners or personal) and scam calls. Table 1 presents the descriptions of different spam calls in each category.

In general, fundraising calls aim to collect donation for political organizations and charities. Telemarketing calls either try to identify potential customers for a business (referred to as 'lead generation' calls in telemarketing terminology [21]) or try to sell a product. On the other hand, scam calls include all sorts of calls trying to deceive people into making

a payment or revealing sensitive information to gain illegitimate benefits.

We observe that a spam call usually starts with a composition of the following turns from the caller (see [63] for an extensive analysis of informal call beginnings):

- Greeting (e.g., 'Hello')
- Self identification (Name of the call agent)
- Company identification (Name of the business)
- Warm up talk (e.g., 'How are you today?')
- Statement of the reason of the call
- Callee identity check (callee's name and attribute)

While identifying the company, spammers often use phrases assuring the legitimacy of the business. While the telemarketers use phrases like "licensed, bonded, insured company", scammers are likely to use a illegitimate or fake company name referring to a well-known institution (e.g., 'Windows service center' or 'US Grants and Treasury Department').
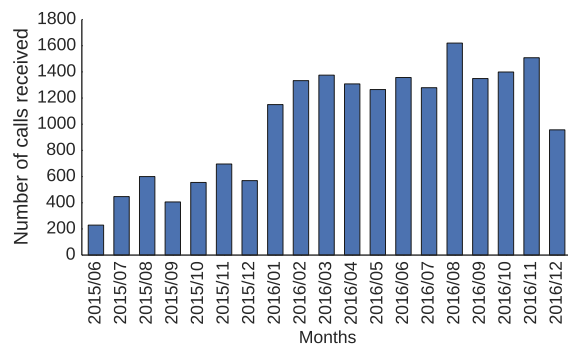
Figure 5: Number of calls received by the PBX server each month.

Figure 6: Interaction of different type of spammers with Lenny.

However, here we do not judge the legitimacy of the involved businesses in telemarketing and fundraising calls. Nevertheless, these calls are unwanted (as the user transferred them to Lenny) and often aimed to manipulate customers.

Callee identity check usually aims to verify that the callee is the 'decision maker' (e.g., the owner of the house or business) or he is in need of a certain opportunity (such as lowering interest rates for credit card debt).

To better convince the customers, spammers make several promises throughout the call, such as they will give a free estimate with no obligation, cancellation is easy or free, the price is all inclusive or there will be a lifetime warranty. Another strategy is to pressure the customer for a quick decision. For example, some scams start by congratulating the person to make him believe that he won something and this is a limited time offer (e.g., "valid only for today"). On the other hand, some calls start with a threatening scenario such as "your computer is getting infected", "your air duct system is badly contaminated" or "there are 8,000 home invasions everyday in the US".

During the call, spammers ask several questions, some of which are summarized in Table 1. We believe that even if the customer does not qualify or does not accept the offer for the moment, this information is collected to broaden and verify information on customers, which can be used for more efficient advertisement in the future [66].

The final purpose of the spammer is often to convince the customer to make a payment (e.g., by giving credit card information or home address for the bill), or to get an appointment for further interaction. We frequently observe that the spammer does not give the customer an option to decline. Instead, he asks to choose between two different products or services. For instance:

- Donation for a political party: spammer asks if the customer wants to donate $625 or $500, later in the call $425 or $375, and later, $250 or $100.

- Appointment for home improvement technician: spammer asks if the customers prefers 2:30pm or 4pm.

- Medical equipment: spammer asks if the customer needs a knee brace or a back brace.
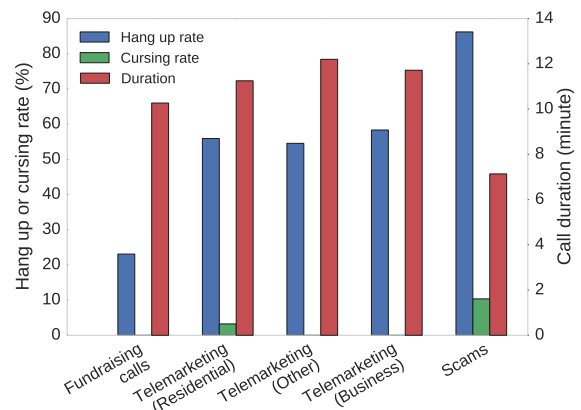
4.2.1 Interaction with Lenny

Before we analyze Lenny's conversational properties, we would like to present some statistics on how spammers interact with Lenny. In our dataset consisting of 200 calls, spammers on average spend 10:13 minutes talking to Lenny. These conversations include an average of approximately 58 turns (an exact calculation is difficult due to overlapping speeches). Moreover, 72% of calls contain Lenny's set of scripts repeated more than once. On average, a caller hears 27 turns of Lenny, which corresponds to 1.7 times repetition of the whole script. These results show that Lenny is a quite successful chatbot in continuing the conversation.

Surprisingly, in only 11 calls (5% of all calls), the caller realizes and states that he is talking to a recording or an automated system. Additionally, 5 of them notice the repetitions in Lenny's turns and state that "something is wrong" with Lenny. 7 spammers think that Lenny has dementia or alzheimer and/or try to contact his nurse, whereas 4 other ones ask Lenny if he is playing a prank on them. 2 of the spammers who realize Lenny is a recording say that they are still getting paid for the call, one even threatens him to be calling every morning at 8:30 am [10]. Moreover, several spammers aggresively try to interrupt Lenny by shouting phrases like "sir please stop" or "listen to me", or even by clapping hands.

In Figure 6, we analyze how spammers' behavior vary in relation to the different type of spam calls. The *hang up rate* shows what ratio of the spammers hang up the call on Lenny, without a proper closing turn. Even though Lenny's never-ending turns make it hard to leave the conversation, some spammers try to politely end the conversation by pretending that they are not able to hear Lenny or they have to leave for a meeting, and saying that they will call back at a later time. The *cursing rate* shows the ratio of spammers from each category that use bad language and swear words. Finally, we present the average call duration for each category as well.

Looking at Figure 6, we can say that fundraising calls are more polite than others. Such calls often come from charities and political organizations, who usually care about their reputations and impressions they make. Telemarketing calls

Table 1: Categorization and description of spam types.

Category	Descriptions of spam types	Requested personal information
Fundraising (14 calls)	**Political** calls to collect donations for political parties or organizations **Charity** calls to solicit contributions for charities	- Political affiliation - Credit card information - Email
Telemarketing targeting home owners (93 calls)	**Home improvement** calls offering discounts and free price estimates on various work needed around the house, like **window&door replacements** **Furnace and air duct** cleaning/upgrade promotions **Solar energy** calls offering free installation of solar panels to provide lower rates on electricity bills **Security alarm system** companies offering installation of a free (or discounted) alarm system (but requiring a monthly monitoring fee) **Energy providers** offering discounted, flat rate utility bills **Communication providers** offering phone/TV/Internet bundles	- Age of the house - Age of furnace or air conditioning - If the callee is married or single - Recent electricity bill, current energy provider - Recent Internet bill, current provider - TV count in the house - Home address
Telemarketing targeting business owners (12 calls)	**Office supply** company offering discounts and free shipping on orders **Business directories** offering premium business listing	- Business name - Location
Other consumer centric telemarketing (22 calls)	Medication or medical equipment offers, extended car warranty, newspaper and magazine subscriptions	- Medical history, pain problems - Car mileage - Credit card or check address
Scams (59 calls)	**Technical support scams** offer a fake tech support service and request money **Vacation scams** offer a free vacation, but the customer needs to pay for government/port taxes **Credit card scam** offers lower interest rates on credit card debt, but the customer gets no real benefits **Advance-fee and cash advance scams** promise a sum of money, or funding for businesses, but the customer needs to pay up-front fees **SEO scam** offers guaranteed rankings on search engines (claiming relation to a well known company)	- Full name, email - Credit card information - Credit card balance - Current bank interest rate - Business profit - Business name, website

show similar characteristics, regardless of the call target. On the other hand, scammers are the rudest callers with 89% hang up rate and use of swear words in 10% of calls.

We also apply Chi-squared and Fisher's exact tests on hang up rates and observe a statistically significant relation between the hangup rate and spam category (telemarketing, fundraising, scam): for the significance level of 0.05, p-values are less than 0.0001.

As opposed to the polite demeanor observed in [54], we find tech support scammers to be particularly rude against Lenny, with 100% hang up rate and 20% cursing rate, probably because Lenny does not comply with their instructions.

Scam calls also have a noticeably shorter average call duration compared to other spam types. Applying a two sample T-test (p=0.05) for each pair of the three categories shows that the duration of scam calls are indeed significantly different from both fundraising and telemarketing calls. Again, a possible reason is that the scammers do not want to waste time with Lenny, once they realize that Lenny will not answer their questions or do what they ask. However, fundraising and telemarketing calls do not have a significant difference between them.

5. USABILITY OF LENNY AS A CONVERSATION PARTNER: AN APPLIED CA APPROACH
Lenny's efficiency is closely related to how the pre-recorded, pre-defined turns are able to do the job that is inevitably, and unremarkably done during each call, to solve the multi-

1. L: hel<u>lo</u>: eh eh this is lenny!
2. L: hi uh uh ss- sorry, I'b- (0.3) I can barely hear you there?
3. L: °ye-° <u>ye:s</u> yes yes
4. L: <u>oh</u> good >yes, yes, yes<.
5. L: uh yes, yes. uh: uh uh, someone, someone did (.) did ss- say last week (abou-) someone did call last week about the same (.) thing, .h wa- was that was that you?

Figure 7: CA transcript of the first pre-recorded Lenny's "turns" (formatted with [46]).

ple, interrelated tasks which come from the fourth levels of the organization of talk (Section 2.3).

5.1 The Structure of Lenny's Turns
Figure 7 shows the first five turns of Lenny (T1 to T5). After a direct, informal reception of the call in which he gives his first name (T1), Lenny introduces a hearing issue (T2), then produces a first "yes" turn (T3), followed by a more enthusiastic one (T4), and a last "yes" turn which has a second part, a verification question about a past event (T5). From a CA perspective, those pre-recorded items have both sequential and turn-constructional features, which refer to the organization of sequences in interaction and to the organization of turn management.

Each turn is supposed to play a specific role in the construction of the sequences of actions which will be built in each call. Though it is not possible to say in advance what those sequences will consist of, the design of the turns will foster a

specific sequential development. CA stress on two features of turns in sequence: a turn is addressing the immediate preceding talk (it is "context-shaped" [38, 60]); and a turn is projecting some next action (it is "context-renewed"). Some turns become parts of a two-unit sequence, the Adjacency Pair. Though T1 and T2 have been designed as first pair parts, which project second pair parts, both T3 and T4 are designed as second pair parts of an adjacency pair (i.e., that they are supposed to follow a question, a proposal, request, etc.). Moreover, the beginning of T4 adds two other components: "oh", a turn-initiated particle.[4] which has been demonstrably analyzed as a change-of-state token [37], a prefaced response [39] and is frequently linked to the making of assessment [40], in particular when it is followed by some assessment token, such as "good", and the three enthusiastic "yes" which end the turn. This design suggests that the turn can get some local sense from several second positions besides the yes/no questions and confirms that this turn is supposed to be "backward looking" [37]. T5 sounds as a verification question and presupposes that the reason for the call has been previously introduced by the caller. Then this turn has a distinctive sequential property: it has been built to occupy a more specific sequential position in the call (the position after the reason for the call).

From the perspective of CA, Lenny's turns share another feature: they have been designed to display repair related features. Almost all turns display self-initiated self-repairs (T.1, 2, 3, 5). The initiations are produced through cut-off (1.&, 2) or "uh" types. The proper repairs are produced through repeats (T5) or transformations (T2). It has been suggested that a high frequency of "disfluencies" in talk features the class of age of the speaker [43]. Along with the pitch of his voice, such disfluencies facilitate the possible recognition of Lenny as an "old man" and bring an easy explanation for some other understanding troubles which might occur. The availability of this membership category [58] can be used by telemarketers, in some calls, as a relevant account for other features of Lenny's talk.

Inspecting Lenny's turns in isolation is not sufficient enough to understand how Lenny can be so efficient in so many different calls. This efficiency is locally built in each call development. Once embedded into a real call, Lenny's turns display an understanding of prior turn and brings new material to be understood by his co-participant. This in situ inspection of Lenny's turn is inevitably made, with more or less care, by the participants, in order to build their own contribution and to fit each new turn into the ongoing conversation. This is what CA calls the "next-turn proof procedure" [59] and what explains the various, flexible ways in which Lenny's turns can play their part in some calls.

5.2 An analytic insight on the opening section of Lenny's turns

On one hand, most telemarketers use very detailed scripts while talking to a prospect. For this reason, the call trajectories might seem to be even more routinely organized than the informal talk on the phone. On the other hand, the Lenny corpus displays different types of calls (See Table 1) and several different caller objectives. This tension between

routine and diversity can be seen in the various sections which compose the beginning section and is solved, in some way, by Lenny's style of participation. In the limited space of this paper, we will only examine the beginning section, because it is often a strategic place in which the trajectory of calls is prepared and launched.

In this paper, the beginning section will refer to the talk which has been produced before the production of the reason for the call.

5.2.1 Calls with minimal beginning section

Some calls do not display any beginning section: the reason for the call is given in the first possible position in the call, just after Lenny's first turn.

In a very few calls, this is done without any self identification of the caller (Fragments 1, 2) or with a minimal identification (Fragment 3).

Fragment 1.

1.	Lenny: hell<u>o</u>: eh eh this is lenny!
2.	Adam: yeah mister lenny, you have been chosen to get a lower interest rate, so (I believe) you have pressed one to get a lower interest rate right?
3.	(0,6)
4.	Lenny: hi uh uh ss- sorry, I'b- (0,3) I can barely hear you there?
5.	Adam: I'm saying so I believe you have pressed one to get a lower interest rate, right?
6.	(0,6)
7.	Lenny: °ye-° <u>ye:s</u> yes yes.

In turn 2 of Fragment 1, the caller goes directly to the point, without even a self identification, an identity check question to the callee, a greeting or any other item. The caller addresses the callee with the first name he has given in his first turn. This is the first adaptation of the script to the specificities of this call with Lenny. Then the business of the talk is addressed with no more preparation but it refers to a previous action which the caller has been accomplished on the phone ("pressing one"). Let us remark that true or not, its aim is to focus the attention of the callee to bring an answer in the next turn and to attend to the call. In this sense, this turn makes the organizational job to drive the callee's attention right to the business of the call. From a sequential perspective, this is a not any kind of yes/no question [56]: the "polarity" of the interrogative embodies a preference for a "yes". From the management of turn perspective, an important consequence here is that a positive answer will give the floor back to the caller. Then it provides the caller with a convenient, quick way to get into the call and to project a next slot for his following question. How Lenny's first turns handle those opportunities? First, the T4 initiates a repair sequence, which is answered by a partial repetition of the first caller's turn, the last yes/no question. Because Lenny's next turn is precisely designed as a "yes" answer, it does the job, selects the preferred answer – a "type-conforming response" [56] and the caller can ask the next question.

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[4]"oh" is the "second most common turn-initial object in English conversation" [41, 55]

Fragment 2.

1. Lenny: hell<u>o</u>: eh eh this is lenny!
2. Caller: injured, retired and elderly fop members, as well as create and maintain a state memorial for officers tragically killed in the line of duty. now sir when you receive your pledge kit, can the pennsylvania fraternal order of police foundation count on you for a fully tax deductible donation?
3. (0,6)
4. Lenny: hi uh uh ss- sorry, I'b- (0,3) I can barely hear you there?
5. (1)
6. Caller: oh I was just saying the goal of the drive is to help provide assistance to families in local lodges when fop members are killed in the line of duty. assist injured, retired and elderly fop members, as well as create and maintain a state memorial for officers tragically killed in the line of duty. now sir when you receive your pledge kit, can the pennsylvania fraternal order of police foundation count on you for a fully tax deductible donation?
7. (0,6)
8. Lenny: °ye-° <u>ye:s</u> yes yes.

In the donation call (Fragment 2), the caller again rushes into the presentation of the reason for the call, but in a somewhat different way. Though this long turn is finished with a yes/no question and then orients to a third turn for the caller, the donation proposal has been prefaced by a long attempt to emotionally engage the callee into a supportive action for police officers and their families who are in difficulty. Thus, it aims to trigger a yes answer. Lenny's turn fit very well into this second beginning.

In the two following fragments, the caller rushes into the business of the call after a short self identification.

Fragment 3.

1. Lenny: hell<u>o</u>: eh eh this is lenny!
2. (0.6)
3. Lenny: hi uh uh ss- sorry, I'b- (0.3) I can barely hear you there?
4. Jeff: hi, sir, my name is jeff, I'm calling you from business loans center (.) to offer you a cash advance for your business. are you interested?
5. (0,6)
6. Lenny: °ye-° <u>ye:s</u> yes yes.
7. Jeff: oh. (.) okay, let me ask you a few qualifying questions then. (.) are you the business owner?
8. (0,6)
9. Lenny: <u>oh</u> good >yes, yes, yes<.

In Fragment 3, this self identification is completed by an identification of the institution he is calling on behalf. Then the caller brings immediately a question to the attention of the callee. This is a cash advance proposal oriented to business owners. From this, we can guess that the phone number has been found on a list of business firms. In such cases, because the reason for the call has been built as an attention getting device, the identity verification check is made after this turn. Here, after Lenny's first "Yes" answer (T.6), the caller adds an identification question which is formatted as a question about the callee's professional status.

Fragment 4.

1. Lenny: hello: eh eh this is lenny!
2. Caller: oh hi I'm calling at HVAC heating and air we're going to be in the area during the maintenance for thirtynine dollars if you haven't done this yet as a as a promotion we're doing for the next month ok but it does include air duct cleaning and under filter and a safety inspection for the furnace,
3. (0,6)
4. Lenny: hi uh uh ss- sorry, I'b- (0.3) I can barely hear you there?
5. Caller: ho. uh ha- have- have you had a maintenance done on your furnace this winter ?
6. (0,6)
7. Lenny: °ye-° ye:s yes yes.
8. Caller: ok we are offering it for a half price right now.

In Fragment 4, the caller quickly identifies the firms he is calling from, to announce the reason for the call, a promotional offer. Note that after the repair initiation of Lenny (T4 here), the caller does not repeat the promotional offer but recycles it as a verification question which gives him the floor back to re-introduce the offer in the following turn, after Lenny's "Yes" turn (T7 here).

5.2.2 Calls with beginning section: a progressive entry into the business of the call

In most calls, however, the caller does not introduce the reason for the call directly in the first turn. He first greets Lenny back, adds a self identification and/or a "how are you" question.

Fragment 5.

1. Lenny: hell<u>o</u>: eh eh this is lenny!
2. Caller: hi sir good afternoon this is michelle with cool duct air-conditioning and heating how are you today ?
3. Lenny: hi uh uh ss- sorry, I'b- (0.3) I can barely hear you there?
4. Caller: ow okay. hu this is michelle with cool ducted air-conditioning and heating. (.) Is that bett[er ?
5. lenny: [°ye-° ye:s yes yes.
6. Caller: okay, uhm : I was calling about the summer maintenance for your central air conditioning,
7. (0,6)
8. Lenny: oh good >yes, yes, yes<.
9. Caller: ok we're running a special right now it is more than fifty percent off and we do a 50-point tune-up on your unit now with our service we replace your filter with a free reusable filter and we talked off the refrigerant up to a pound at no charge ok it's automatically a hundred dollars savings ok now uhm the technicians going to also do a complete mold and mildew inspection flushing vacuum out the drain line to get rid of the build-up and then treat it without the side tablets ok so on it will prevent the build-up of mold and mildew and kill bacteria so you're getting better quality air in your home he'll also check your ducts to make sure there's no tears or separations anywhere that you're losing energy ok we wanted you should save up to twenty percent on your monthly electric bill ok now he'll also check your air handler, calibrate the thermostat make sure it's accurate the voltage and

> the amperage on the motors the starting capabilities to make sure the A/C is turning on and off when it's supposed to fill sanitizer evaporation oil and oil and lubricate all the moving parts. ok now more importantly you'll get the state certified report to validate your warranty cap that's your proper documentation. okay and our special right now is only forty-four dollars not a penny more that includes the taxes you're 50 point tune up your free filter free refrigerant along with a hurricane safety inspection also free and there is no trip charge or we could take care of you tomorrow.

In the opening of Fragment 5, the presentation of the reason for the call is prefaced with a first multi-units turn in which the caller introduces a greeting, a self identification, and an identification of the firm she is calling for, before adding a "how are you" question. Note that the next turn, in which Lenny initiates the "hearing" repair, is answered as a partial repeat from which the "how are you" is now absent. Michelle completes this turn as a hearing check, with a yes/no question. Then Lenny's first "Yes" turn fits well in this sequential environment and displays a confirmation. In turn 6, Michelle, the caller, introduces a first characterization of the "reason for the call", which is often briefly presented in the opening section. Lenny's enthusiastic second "Yes" turn (T.8) sounds, in this sequential context, as an authorization to expand the previous announcement.

In fragments 6 and 7, the identification questions have been introduced before the reason for the call. In Fragment 6, the identification question is about the callee's name, while in the next fragment (7), the identification sequence is relative to a role.

Fragment 6.

1. Lenny: hell<u>o</u>: eh eh this is lenny!
2. Caller: hello, am I speaking with mister ( )
3. Lenny: hi uh uh ss- sorry, I'b- (0.3) I can barely hear you there?
4. Caller: oh I'm sorry about that, can you hear me now mister ( )
5. Caller: °ye-° <u>ye:s</u> yes yes.
6. Caller: okay, okay, ah mister ( ) my name is lui by the way. how are you doing today?
7. Caller: <u>oh</u> good >yes, yes, yes<.
8. Caller: okay, good. um I was just giving you a call at this time because one of my reps had spoke with somebody in your home. um today I was just following up just to see if anything has changed since we last spoke with you. if you need any free estimates for any home repairs that you're trying to get around to or you may have in mind at all?

The first identity verification question has been asked in turn 2 by the caller. Then the caller produces a hearing check in turn 4, using the name of the prospective callee. Because Lenny's next turn is the first "Yes" turn, it displays an embodied acceptance of the addressee term and then closes the identity issue. After a "how are you" question, who confirms the expected progression of the call, the caller introduces the reason for the call in next turn. Sometimes the identity check is not focusing on the name of the callee, but on his tendency to be the right person to speak with in the context of the type of offer or proposal which is about to be made.

Fragment 7.

1. Lenny: hell<u>o</u>: eh eh this is lenny!
2. Brianna: I need to speak to the person that handles the clp electric bill, is that you?
3. Lenny: hi uh uh ss- sorry, I'b- (0.3) I can barely hear you there?
4. Brianna: I need to speak to the person that handles the clp bill - electric bill - is that you?
5. Lenny: °ye-° <u>ye:s</u> yes yes.
6. Brianna: hello, my name is brianna, I'm calling on behalf of spark energy in regards to the connecticut electric choice program. do you recall receiving that information, sir?

The identification check, which has been introduced in her first turn by Brianna (Fragment 7), the caller, aims at finding the right person who is responsible for some task (here the electric bill). She repeats the same question after the hearing trouble question from Lenny. In this sequential context, the "Yes" turn displays a positive answer to the identification question. This understanding is embedded in how Brianna is pursuing the call with the reason for the call. No doubt that Lenny is the right addressee.

Fragment 8.

1. Lenny: hell<u>o</u>: eh eh this is lenny!
2. Brian: hi lenny this is brian security specialist how are you today.
3. Lenny: hi uh uh ss- sorry, I'b- (0.3) I can barely hear you there?
4. Brian: my name is brian it's a pleasure to make your acquaintance lenny how'r yu
5. Lenny: °ye-° <u>ye:s</u> yes yes.
6. Brian: have you ever had a security system for yourself.
7. Lenny: oh good yes yes yes.
8. Brian: do you have a security system ?
9. Lenny: uh yes, yes, uh::uh, someone, someone did say last week or some- one did call last week about the same (.) thing, wa-was that, was that, you?
10. Brian: it wasn't me it might have been someone else to my company or something, .hh but do you need do you have a security system.

In such a sequential structure, the identity check or other verification questions ("Are you in front of your computer? Do you have a security system?") can be built as pre-sequences, which will sometimes freeze the introduction of the reason for the call. In Fragment 8, after the presentation and the "how are you" turn (T.2, 4), the caller introduces a verification question which is supposed to preface the offer. The telemarketer tries to ask Lenny whether he has a security system (T.6), but does not accept Lenny's the second enthusiastic "yes" turn (T.7) as a proper answer. Then, the telemarketer repeats the question (T.8). The next Lenny's turn, which begins with a "yes", could have been a second possible acceptable answer to the question, but the telemarketer keeps repeating the question (T.10). The several repeats of the same question display that there is an incoming issue in the conversation which has been noticed by the caller.

Nevertheless, such instances are very rare in the corpus. In most cases, Lenny does the job and the reason for the call can be introduced. The five first turns adjust to the vari-

ous different sequential openings which have been found and get different senses from their positions in these sequential environments.

6. DISCUSSION

Lenny's efficiency is not only related to the specific design of Lenny's turns, but also to the orientations displayed by the caller in his proper turns. The caller's turns display his local understanding of Lenny's turns and he treats Lenny's turns as displaying some understanding of his own contributions. To a certain extent, it does not matter that Lenny's turns are fixed, pre-recorded items, as long as this feature is not discovered by the caller himself during the conversation. The practical sense of each turn at talk, either Lenny's ones or the caller's contributions, is embedded into the meaningful web of the call in progress.

A conversation analytic perspective on Lenny's calls reveals that the smartness of a bot can not be hidden in a sophisticated AI but in its tendency to participate to the sequential development of the relative diversity of calls without "freezing" the call. We have shown that this tendency is based both on the specific design of Lenny's turns and in their capacity to merge with the various sequential environments of different types of spam calls. We will complete in forthcoming papers this first study of openings with broader analysis of other sections of the same calls: the core parts of the calls, and the conversational treatment of the looping mode. Meanwhile, we would like to focus on the complexity of Lenny's character, which makes it difficult to replicate, while keeping its "botness" less visible for the caller.

6.1 Lenny the subtle bot

Lenny's talk displays a specific perspective which is very balanced in relation to the main orientations of the callers. Like other professional phone talk settings, unsolicited spam calls are script-guided and goal-oriented [27]. As Mazeland [52] has pointed out in one of the very few conversation analysis studies on telemarketing, the operators try to take control over the interaction with "initiatory actions" (i.e., first pair parts).

Accordingly, one of their first jobs is to check that Lenny can be correctly addressed as a member of a specific category (e.g., business owner) who is therefore entitled to [44, 58, 72] perform a specific activity (e.g., contracting a loan). Callers have little interest, if any, in addressing Lenny as an incumbent of other social categories (e.g., "grandfather") or collections of categories (such as "family"). For the same reason, callers are not "topically" oriented: they have no specific interest in "talking" about other topics that people usually used to bring into ordinary conversations.

Lenny's talk displays some features which foster callers: he is ready to talk; he displays some positive alignment in the very first turns to the reason for the call; he provides some confirmation of the requested identity. Then the callers have to deal with other aspects of Lenny's conduct, which complicates their job. First, they have to address the several repeat queries and verification questions from Lenny, without getting lost in the script that most operators hearably follow. So many repetitions tend to threaten the very work of turning the script that scammers use into the conversation. Repetition queries disturb the organization of the script: some callers used to jump to the next scripted turn instead of repeating their previous turn. Second, callers have to find ways to deal with Lenny's narratives, which are centered on family matters. Either they display alignment as possible recipients to such narratives, or they keep some distance with them and try to come back to their business talk as soon as they can. Both repeat queries, confirmation queries, and self narratives allow Lenny to control the turn management and/or sequential progressivity. Such attempts are difficult to handle, because most callers share the same orientation to a scripted interrogative series through which they keep control over the conversation.

Lenny's efficiency is deeply rooted in its propensity to maintain such a balanced orientation towards the call. Lenny leads the callers to adjust their own talk to the specificities of callee's productions, while maintaining a continuing, positive orientation to the business of the call. Its brilliant design lies in the subtle equilibrium it preserves between control and alignment.[5]

6.2 Usability of Transferring Calls to Lenny

In this paper we did not study the user aspect of transferring calls to Lenny. In fact, we have limited control and data on this aspect of the deployment, but in general the usability of the call transfer is quite poor. Requesting a user to perform multiple steps to transfer the call is not likely to scale well with the general public. On an enterprise desk phone where buttons can be configured to automatically transfer calls to a given phone number, the operation can be straightforward. On the other hand, such tasks are difficult to automate on mobile phones: call control APIs are very limited and the audio of a call is in general directly handled by the mobile baseband chip. As a consequence the audio stream is not easily accessible by applications on unmodified smartphones. Thus, automating the use of such chatbots with a smartphone application, without the involvement of an operator side telephony system, is currently very difficult to achieve. Nevertheless, the number of people using Lenny have been increasing as its popularity increases among the online community.

6.3 Comparing Lenny with Existing Voice Spam Countermeasures

Chatbots like Lenny does not necessarily prevent voice spam, in fact, using Lenny may increase the number of unwanted calls one receives, due to getting marked as a potential customer. In this respect, Lenny does not really compare with the other voice spam countermeasures that often aim to detect and block spam calls [69]. In fact, the recipient will still be disturbed with the call, and will need to make a decision on the call type (spam or not) to transfer the call. Moreover, the usability issues with call transfer and the possible need for a third party system reduces the scalability of such chatbots.

6.4 Effects on the Economics of Voice Spam

Lenny provides an opportunity to stall fraudsters and slow down economics of voice spam, by directly and indirectly increasing the cost of a failed telemarketing or scam call.

To spend 15 minutes or more of a working time with a Lenny-like bot represents a direct cost for spammers. More

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[5]More Conversation Analysis work will be necessary to gain a proper understanding of the skilled Lenny.

importantly, it also results in an opportunity cost, because the spammer will not be able to target other legitimate customers during this time. This increases the call costs until reaching a valid customer and decreases the volume of calls a single spammer can generate in a certain time period [68]. On the other hand, victims could save time by using the chatbot instead of declining the proposal or dropping the call.

Depending on the expected monetary benefit of a spam scheme and the rate of use of chatbots, a spam campaign may become less profitable, or even not be economically viable. However, this would require a large number of chatbot users. In fact, a recent survey shows that more than 90% of participants do not listen to telemarketing proposals until the end; they either politely decline or hang up the call [24]. Another benefit of the generalization of such a service would be to reduce the economic damage of voice spam on society, both due to the direct monetary losses [48], and due to the reduced productivity [25].

A possible consequence is that the spammers will get acquainted with the chatbots and be able to quickly recognize and avoid them. Thus, a generic framework could be useful to simplify the creation of personal chatbots, e.g., providing guidelines on script preparation.

6.5 Guidelines for the design of Lenny-like bots

In the near future, we will try to develop the implications of our findings on the design of anti-scam chatbots thanks to a closer collaboration with their designers, either profane or professionals. For the time being, we propose some general guidelines for the design of such bots, based on our preliminary analysis of Lenny's usability:

- Maximize the coherence between all easily recognizable features of the chatbot which are available at first hearing: the voice, the local accent, the gender and the class of age membership have to be congruent in some way. Other category memberships can be revealed during the call: For instance, the callee can reveal that she is a "mother", a "daughter" or a "musician" during one of the narratives.

- The first available recognizable identity of the bot has to be tied, in one way or another, to the production of a series of specific type of turns: repeat queries. Design carefully a variety of repeat queries which can be based on different motives: hearing issues, connection problems, technical problems, incidents during the calls, interruptions from co-present others, etc.

- Design a list of queries checking the identity of the caller, the proper name of the institution he is calling on behalf, how much time he needs for this call, the precise nature of his firm's main activities, etc.

- Design three or four multi-unit turns. In each of these longer turns, the first unit which begins the turn has to display that the following turn will not be connected to the previous ones, using a "misplacement marker" (e.g., "by the way". See [60]). The following turn constructional unit will deliver a narrative about some event which is coherently tied to the first, recognizable,

membership category of the caller or, on the contrary, which will add a new tied category membership. During the narrative, do not forget to design some short pauses after each main narrative component in order to invite the hearer to display some recipiency.

- Design an attention checking turn ("hello?" or "are you still there?") which will be activated after a few seconds of silence (the exact duration should be confirmed with a few tests) after any turn of the chatbot.

- Design carefully the sequential order and the design of the first turns, which will facilitate or block the initiation of the call and the introduction of the reason for the call.

- The script has to preserve an equilibrium between turns which project a next turn from the caller (first pair parts) and responsive turns which have to display a positive orientation to the previous, unknown caller turns.

- Record at least twenty turns, or more to prevent the risk of the looping mode, which may reveal that the callee is a bot.

This list of design proposals has been conceived from our efforts to understand the effectiveness of Lenny. Therefore, its purpose is to facilitate the design of Lenny-like bots to be used in the specific and limited context of scam calls, not to provide a series of rules for bot design. The efficiency of Lenny-like bots will rely on the unfolding course of each conversation and will rest on the situated understandings of the callers, who adjust their actions accordingly.

7. CONCLUSION

Voice spam is a prevalent, yet unsolved problem affecting telephone users. In this paper, we study a particular anti-spam chatbot, *Lenny*, which was created to fight such spam calls with a set of pre-recorded voice messages.

We first present several statistics showing that despite its simplicity, Lenny is very effective in dealing with phone spammers. Then, we propose to investigate the usability of Lenny from the perspective of Applied Conversation Analysis. We highlight the complexities of Lenny which are "seen but unnoticed" [34] by his co-conversationalists. Despite the apparent simplicity of this 16 pre-recorded turns chatbot, we show that its success relies on a sophisticated equilibrium between contrastive features: These features give it the necessary flexibility to fit into several sequential organizations, while keeping sufficient control over the interaction.

Our study also reveals various insights on the voice spam landscape and common strategies of phone spammers. Finally, we discuss several factors on the usability of chatbots against voice spam and possible effects on spam economics. We believe that widespread adoption of diverse chatbots can be effective in decreasing financial incentives of spam campaigns.

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APPENDIX

A. ROUGH TRANSCRIPT OF A TELEMARKETING CALL

[00:00:00] Lenny: hello: thi- this is Lenny!

[00:00:03] Telemarketer: lenny, i'm looking for mr. [00:00:04 sound cut]

[00:00:06] Lenny: uh-- sso- sorry, I'b- I can barely hear you there?

[00:00:13] Telemarketer: homeowner.

[00:00:15] Lenny: ye- yes yes yes.

[00:00:19] Telemarketer: mr. [00:00:19 sound cut] we're giving free estimates for any work
    you need on your house. were you thinking about having any projects? a little craning
    driveway, roof work, anything you need done. we'll give you a free estimate.

[00:00:31] Lenny: oh good, yes, yes, yes.

[00:00:34] Telemarketer: what would you like to have done? what were you thinking about?
    anything around the house?

[00:00:39] Lenny: uh yes, yes, uh::uh, someone, someone did- did say last week or some- one
    did call last week about the same (.) thing, wa-was that, was that, you?

[00:00:50] Telemarketer: no, sir. i've might have been in another company. what was it that
    you were doing?

[00:00:55] Lenny: ye-yes. ss- sorry, what- wa- what was your name again?

[00:01:00] Telemarketer: yes. what were you thinking about having done?

[00:01:04] Lenny: well, it- it it's funny that you should call, because, my third eldest
    larissa, uhh, she, she was talking about this. (.) u:h #just this last week and .hh you
    you know, sh- she is-, she is very smart, I would- I would give her that, because, you
    know she was the first in the family, to go to the university, and she passed with
    distinctions, you know we're- we're all quite proud of her yes yes, so uhh:: yes she was
    saying that I should, look, you know, get into the, look into this sort of thing. uhh so,
    what more can you tell me about it ?

[00:01:14] Telemarketer: #mm-hmm. okay. alright. well, good, good. [inaudible 00:01:33] so
    you're very proud. okay.# well, we are full-service construction company. we do
    everything from the roof to the foundation. we've been in business for over 32 years. we'
    re licensed, bonded, and insured, and we have plenty plenty of references if you need
    them. where you thinking about doing any work inside or outside?

[00:02:05] Lenny: I: I am sorry, I, I (.) couldn't quite catch you th-, catch you there. wha-
    what was that again?

[00:02:12] Telemarketer: where you thinking about doing work inside or outside?

[00:02:17] Lenny: uh. ( ) the: (.) ss sorry, aw again?

[00:02:23] Telemarketer: [laughs] where you going to do work inside or outside?

[00:02:28] Lenny: cou-could you say that again- again please?

[00:02:32] Telemarketer: i tell you what, i'm going to send one of my guys over to your place
    . you're at six [00:02:37 sound cut]. he can sit down with you. he'll discuss everything
    about our services. he'll give you our coupon. it's up to 50% off. i'll have him there,
    let's see it's 12:30, i can get him over there by 2:30. are you and your wife be home at
    2:30? we'll come by, show show you all our stuff and you can let us know what you wanna
    do then. okay.

[00:02:59] Lenny: yes, yes, yes...

[00:03:01] Telemarketer: that makes sense?

[00:03:03] Lenny: sorry uhh, which company did you say you were calling from again?

[00:03:08] Telemarketer: wise. w-i-s-e. it'd be very wise for you to use our services. that's
    our commercial.

[00:03:15] Lenny: well, you know. here's- here's the thing because the last time that I--that
    someone called up, uh #and spoke to me on the phone, I got in quite a bit of trouble
    from--with the people here because I went for something that I shouldn't have. uh, I
    probably shouldn't be-be telling you that. but um, yes, I-I think m-my- my eldest Rachel,
    she-she uh, uh would-wouldn't speak to me for a week, now, you know that-- that happens,
    you know but uh it bit--that really hurt and-and-and sometimes in the family you know
    these-these things are quite important you know. they're more important than uh--uh any,
    you know, job or-or-- Phone call or-or-- what- wha-- whatever it is.

[00:03:22] Telemarketer: #mm-hmm. umm-hmm. umm-hmm. that's okay? mm-hmm. oh boy she got mad
    at you?# of course, family is always important. now let me asked you. uh, is three o'
    clock going to be good for you and your wife?

[00:04:11] Lenny: well yeah, since--since you-you put it that way, I mean you-you've been
    quite friendly and straightforward with me here. #um, h-hello?

[00:04:20] Telemarketer: #great. very good.# yes, i'm here. thank you.

[00:04:25] Lenny: hello? #are you there?

[00:04:25] Telemarketer: #i'm just saying, thank you.# yes sir, i'm here.
[00:04:30] Lenny: #oh yes-- s-sorry. Is-is--I have a-- have a bit of a--bit of a problem with
    this phone-- --and-and my hearing is not so good. um, yes,# uh, w-wha- sorry, wha-what
    were you saying again?
[00:04:30] Telemarketer: #hello? that's okay. that's okay. no problem.# i just saying that it
    was a pleasure speaking with you as well and we're going to have my guy come out and
    talk to you and your wife about three o'clock. i just wanna be able to let him know what
    it is that you guys were thinking about doing on the house. was it painting or kitchen,
    bathroom remodeling? what was it that you guys wanted to have look at?
[00:05:05] Lenny: well, you know with-with the world finances the way they are I know you
    know we're not-we're not allowed to spend as much as-as what we were. [stammering] how-
    how:: how-how-how is this going to uhh h-how is this going to work?
[00:05:23] Telemarketer: well, we'll have to come out and see what the job is first before we
    could talk about any form of uh, money but, uh, you won't have to worry about that until
    we see what it is that you need done.
[00:05:36] Lenny: #well,that-that-that does sound good. I mean, you-you have been very
    patient with an old man here and uh [laugh] Bt-it's uh-- yeah I mean, uh, it's-it's
    something that-that I've been told that I should be looking at-- uh-, my third eldest
    laris-larissa, she uh, I think I mentioned larissa before (.) yes-yes she uh-- she says
    th-that I should be going for the--something like this but uh, it's just a matter of what
    , you know, what-what is most appropriate for--for uhh th-the time and I guess what not.
    sorry could you-- just hang on# for one second here? hang on. [ducks quacking in the
    background]
[00:05:36] Telemarketer: #what it is that you are thinking of doing? oh, no problem , that's
    -- that's our job. i mean your purpose so. yes what was she said-- she told you to have
    done? mm-hmm-- i got you.#
[00:06:32] Lenny: yeah. so-sorry #about that. uh-- s-sorry# wha-what were you saying there
    again?
[00:06:33] Telemarketer: #yes, sir. that's okay.# i was asking what work that you need done?
[00:06:43] Lenny: uh yes, yes, uh::uh, someone, someone did- did say last week or some- one
    did call last week about the same (.) thing, wa-was that, was that, you?
[00:06:54] Telemarketer: no sir. that may have been another company.
[00:06:58] Lenny: ye-yes. ss- sorry, what- wa- what was your name again?
[00:07:03] Telemarketer: my name is michael.
[00:07:06] Lenny: well, it- it it's funny that you should call, because, my third eldest
    larissa, #uhh, she, she was talking about this. (.) u:h just this last week and .hh you
    you know, sh- she is-, she is very smart, I would- I would give her that, because, you
    know she was the first in the family, to go to the university, and she passed with
    distinctions, you know we're- we're all quite proud of her yes yes, so uhh:: yes she was
    saying that I should, look, you know, get into the, look into this sort of thing. uhh so,
    what more# can you tell me about it ?
[00:07:12] Telemarketer: #mm-hmm, mm-hmm-- what was she talking about? right. what was she
    talking about? what was she talking about? what was she talking about? what were she
    talking about mr. [00:07:32 sound cut]? looking to what sort of thing mr. [00:07:43 sound
    cut] ?# what would she like to have done mr.[00:07:49 sound cut]?
[00:07:51] Lenny: I: I am sorry, I, I (.) couldn't quite catch you th-, catch you there. wha-
    what was that again?
[00:07:57] Telemarketer: what do you want done?
[00:08:00] Lenny: uh. ( ) the: (.) ss sorry, aw again?
[00:08:06] Telemarketer: well, i guess we'll gonna be here a while. what did she want done?
[00:08:11] Lenny: cou-could you #say that again- again please?
[00:08:12] Telemarketer: #i mean bathrooms.# so do you need your bathroom redone?
[00:08:19] Lenny: #yes, yes, yes...#
[00:08:19] Telemarketer: #maybe your kitchen# how about the drive way? maybe even the garage?
    have you done any work on your roof?
[00:08:27] Lenny : sorry uhh, which company did you say you were calling from again?
[00:08:32] Telemarketer: i didn't say, uh, the thing is we were tying to see what did you
    need done.
[00:08:39] Lenny: #well, you know. here's- here's the thing because the last time that I--
    that someone called up, uh and spoke to me on the phone, I got in quite a bit of trouble
    from--with the people here because I went for something that I shouldn't have. uh, I
    probably shouldn't be-be telling you that. but um, yes, I-I think m-my- my eldest Rachel,
    she-she uh, uh would-wouldn't speak to me for a week, now, you know that-- that happens,

you know but uh it bit--that really hurt and-and-and sometimes in the family you know these-these things are quite important you know. they're more important than uh--uh any, you know, job or-or-- Phone call or-or-- what- wha-- whatever it is.#

[00:08:39] Telemarketer: #although i love having this conversation. i get paid by the hours, so the longer i sit, the longer i talk with you, the better um, yeah, right. um, um, how often do you do this? [laughs] this is so much fun. i-- i've never seen anybody have their own routine over the phone. this is quite cool since both of us are going to talk. now i'm thinking this is maybe recording because you can't hear anything that i'm saying to you at this point. so we might as well just go ahead and do this over.# so now you're gonna ask me, "what did i say? i didn't hear you. would you repeat that?"

[00:09:31] Lenny: well yeah, since--since you-you put it that way, I mean you-you've been quite friendly and straightforward with me here. um, h-hello?

[00:09:45] Lenny: hello? are you there? oh yes-- s-sorry. Is-is--I have a-- have a bit of a-- bit of a problem with this phone-- --and-and my hearing is not so good. um--#um, yes, uh, w-wha- sorry, wha-what were you saying again?

[00:09:59] Telemarketer: #i ran into a building, that's not--# did you hear them?

[00:10:15] Lenny : well, you know with-with the world finances the way they are I know you know we're not-we're not allowed to spend as much as-as what #we were. [stammering] how-how:: how-how-how is this going to uhh h-how is this going to work?

[00:10:29] Telemarketer: #[laughs] this is great.#

[00:10:30] Lenny: h-how is this going to work? hello? are you there?uh yes-- s-sorry wha-what were you saying there again?

[00:11:16] [END OF AUDIO]

B. ROUGH TRANSCRIPT OF A SCAM CALL

[00:00:00] Lenny: hello: thi- this is Lenny!

[00:00:04] Adam: yeah mr. lenny, you have been chosen to get a lower interest rate, so i believe you have pressed one to get a lower interest rate right?

[00:00:13] Lenny: uh-- sso- sorry, I'b- I can barely hear you there?

[00:00:17] Adam: i'm saying so i believe you have pressed one to get a lower interest rate, right?

[00:00:24] Lenny: ye- yes yes yes

[00:00:26] Adam: okay, the interest you're paying at the moment is 19.9, right?

[00:00:32] Lenny: oh good, yes, yes, yes.

[00:00:34] Adam: and we are going to drop that down to less than 10% on this same call okay?

[00:00:40] Lenny: uh yes, yes, uh::uh, someone, someone did- did say last week or some- one did call last week about the same (.) thing, wa-was that, was that, you?

[00:00:50] Adam: oh okay, and did they provide you the low interest?

[00:00:56] Lenny: ye-yes. ss- sorry, what- wa- what was your name again?

[00:01:01] Adam: sir i'm saying my name is adam, adam chaw and i'm saying did they provide you the lower interest?

[00:01:09] Lenny: well, it- it it's funny that you should call, because, my third eldest larissa, uhh, she, she was talking about this. (.) u:h just this last week and .hh you you know, sh- she is-, she is very smart, I would- I would give her that, because, you know she was the first in the family, to go to the university, #and she passed with distinctions, you know we're- we're all quite proud of her yes yes, so uhh:: yes she was saying that I should, look, you know, get into the, look into this sort of thing. uhh so, what more can you tell me about it ?

[00:01:29] Adam: #yeah# so as you know today you are getting this call from low interest rate department working for the head office of visa and mastercard and you have been chosen only because of your good payment history. for the past six to seven months, you have been making your payments on time, right? you always try to make more the minimum payments right?

[00:02:10] Lenny: I: I am sorry, I, I (.) couldn't quite catch you th-, catch you# there. wha -what was that again?

[00:02:13] Adam: #you always try to make more than # the minimum payments, right?

[00:02:18] Lenny: uh. ( ) the: (.) ss sorry, aw again?

[00:02:23] Adam: you always try to make more than the minimum payments, correct sir?

[00:02:28] Lenny: cou-could you say that again- again please?

[00:02:31] Adam: sir, i'm asking you, you always try to make your payments on time, right?

[00:02:37] Lenny: yes, yes, yesâĂę

[00:02:39] Adam: okay, and today that's the reason you're getting this call and that's the reason we are going to provide to lo--lower interest rate because of your good payment

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history, okay.

[00:02:50] Lenny: sorry uh, which company did you say you were calling from again?

[00:02:54] Adam: sir, we are working for the head office of visa and mastercard, working with the head office of visa and mastercard and that's the reason we are going to provide you the low interest, okay. so grab your card on hand and verify me the membership number starting from five.

[00:03:09] Lenny: well, you know. here's- here's the thing because the last time that I--that someone called up, uh and spoke to me on the phone, I got in quite a bit of trouble from --with the people here because I went for something that I shouldn't have. uh, I probably shouldn't be-be telling you that. but um, yes, I-I think m-my- my eldest Rachel, she-she uh, uh would-wouldn't speak to me for a week, now, you know that-- that happens, you know# but uh it bit--that really hurt and-and-and sometimes in the family you know these-these things are quite important you know. they're more important #than uh--uh any, you know, job or-or-- Phone call or-or-- what- wha-- whatever it is.

[00:03:40] Adam: #you tell me your eldest--the daughter's name for some correction, yeah mr. lenny i understand that, i understand mr. lenny, that today we are going to provide you the lower interest # on this same call, so i need you to grab your mastercard on hand and verify me the membership number starting from five, can you do that?

[00:04:07] Lenny: well yeah, since-#-since you-you put it that way, I mean you-you've been quite friendly and straightforward with me here. um, #h-hello?

[00:04:08] Adam: #can you grab you card and verify me the membership number? # yes, yeah sir.

[00:04:20] Lenny: hello? are you there?

[00:04:24] Adam: yes sir, i'm here. grab #your card and verify me the membership number starting from five.

[00:04:26] Lenny: #oh yes-- s-sorry. Is-is--I have a-- have a bit of a--bit of a problem with this phone-- --and-and my hearing is not so good. #um, yes, uh, w-wha- sorry, wha-what were you saying again?

[00:04:34] Adam: #[laugh] no problem, no problem.# grab your card sir, your mastercard and verify me the membership number starting from five.

[00:04:47] Lenny: well, you know with-with the world finances the way they are I know you know we're not-we're not allowed to spend as much as-as what we were. #[stammering] how-how:: how-how-how is this going to uhh h-how is this going to work?

[00:04:56] Adam: #yeah sir, i understand, i understand that completely and that's the reason i want to provide you the lower interest on your mastercard. #sir can you grab your mastercard?

[00:05:07] Lenny: well, that-that-that does sound good. I mean, you-you have been very patient with an old man here and uh [laugh] it-it's uh-- yeah I mean, uh, it's-it's something that-that I've been told that I should be looking at-- #uh-, my third eldest laris-larissa, #she uh, I think I mentioned larissa before (.) yes-yes she uh-- she says th-that I should be going for the--something like this but uh, it's just a matter of what , you know, what-what is most appropriate for--for uhh th-the time and I guess what not. sorry could you-- just hang on for one second here? hang on. [ducks quacking in the background]

[00:05:19] Adam: #okay, okay yeah so are you grabbing you card sir or should i hang up?#

[00:05:34] [END OF AUDIO]