Achieving Goals in Collaboration: Analysis of Estonian Institutional Calls

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Abstract

Estonian institutional calls are analyzed with the further aim to develop a dialogue system. The analysis is based on the Estonian Dialogue Corpus. Four types of dialogues are considered: calls to travel agencies and outpatients' offices, ordering a taxi, and directory inquiries. A customer's goal is either to get information or to trigger an action by the operator. This goal is achieved in collaboration with the operator. Sub-dialogues are initiated both by the customer and operator in order to achieve sub-goals of the initial goal. A stack is an appropriate data structure for saving goals and sub-goals.

1 Introduction

Communication between A and B is possible only if the partners have a *shared knowledge*: a common language and world knowledge, a common view of norms and rules of communication; A's knowledge about B should have a common part with B's knowledge about himself/herself, and conversely; the participants should share at least the goal to communicate one with another. In this sense, every communication is collaboration.

In task-oriented dialogues, the cooperative participants additionally have a common goal – to solve a task. A goal can be achieved through a sequence of sub-goals, i.e. setting up and solving subtasks. Solving of every subtask initiates a sub-dialogue.

A simple task-oriented dialogue arises when a customer calls an information center and asks a question. The operator cannot always give an answer immediately. She needs additional information in order to determine the customer's goal precisely, and initiates an *information-sharing* sub-dialogue. Similarly, a customer may start a *clarification* sub-dialogue if the answer does not satisfy his goal. Both partners can initiate *correction* sub-dialogues during a dialogue.

These three kinds of sub-dialogues are differently understood by researchers (Hennoste et al., 2005). Information-sharing is a transfer of knowledge from one participant to another. Sometimes this kind of sub-dialogue is called knowledge precondition sub-dialogue because they are initiated by the agent to satisfy the preconditions of a higher-level goal (Jurafsky and Martin, 2000: 748).

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In this case, an agent tries to elicit knowledge from the partner (e.g. a travel agent asks details of a trip from a customer). On the other hand, a negotiation sub-dialogue can be initiated by an agent to evaluate a proposal of the partner (Chu-Carrol and Carberry, 1995), e.g. a dialogue system (DS) is transferring its own knowledge to the user to resolve its uncertainty regarding the acceptance of a user proposal. In their later publications, negotiation is called a correction sub-dialogue (Chu-Carrol and Carberry, 1998; Jurafsky and Martin, 2000: 748). Correction is considered as a plan change (e.g. a customer rejects a previous plan to travel on Friday and orders a ticket for Sunday), or error correction (Kirchhoff, 2001). Clarification is considered as specification of answer (e.g. after a customer gets the gate number from the operator, he in addition asks for the precise location of the gate), or as solving of communication problems (McTear, 2004). In conversation analysis (CA), solving of communication problems is called repair (Schegloff, 1986). Figure 1 illustrates the different kinds of sub-dialogues and their typical location (A, B – dialogue participants).

A: request/ question B: *information-sharing* A: -"- B: grant/answer	A: request/ question B: grant/answer A: *clarification/ (error) correction / repair* B: -"-	A: proposal B: *negotiation / correction* A: -"- B: accept/reject

Figure 1. Sub-dialogues of a dialogue

Our further aim is to develop a DS which performs the role of an information operator interacting with a user in Estonian. Therefore we studied Estonian human-human institutional calls in order to explain how a customer (A) achieves his goal in collaboration with an operator (B). Three kinds of sub-dialogues are considered in dialogues: 1) information-sharing initiated by B before giving answer, 2) clarification initiated by A after receiving answer, and 3) repairs initiated both by A or B for solving communication problems. Negotiations in sense of (Chu-Carrol and Carberry, 1995) are not considered here because there are few proposals in our analyzed dialogues.

The paper is organized as follows. In Section 2 we give an overview of our empirical material. Section 3 clarifies what do customers ask and which dialogue acts they use in order to set up their goals. In Section 4 we consider different kinds of sub-dialogues used by participants who collaborate for achieving a joint goal – information-sharing, clarification and repair. Section 5 investigates how to model the process of achieving goals by using a stack structure. In Section 6 we will make conclusions.

2 Corpus Used

Our current study is based on the Estonian Dialogue Corpus (EDiC)[1]. The corpus contains about 900 authentic human-human spoken dialogues, including over 800 calls. Dialogue acts are annotated in the corpus. A DAMSL-like typology[2] of dialogue acts is used for annotation (Gerassimenko et al., 2004). For this paper, 144 institutional calls (total 19,938 tokens) were selected from EDiC. Four situational groups are represented in the dialogues: calls to travel agencies, to outpatients' offices, for taxi, and directory inquiries (Table 1). The calls to travel agencies form the biggest part of the selected sub-corpus. The remaining dialogue types are considered for comparison. The dialogues are quite different but they still share an important feature – they all are collaborative. The Workbench[3] of EDiC was used for calculations and analyses.

Table 1. Overview of the corpus

Dialogue type	Number of		Average length: number of	
	dialogues	tokens	utterances	tokens
Travel agency	36	12,104	54	336
Directory inquiries	60	4,384	19	73
Outpatients' offices	26	2,422	24	93
Taxi	22	1,028	13	47
Total	**144**	**19,938**		

[1] http://math.ut.ee/~koit/Dialoog/EDiC.html

[2] The acts are divided into two big groups – adjacency pair (AP) acts (e.g. question–answer) and single (non-AP) acts (e.g. continuer). Names of dialogue acts consist of two parts separated by a colon: the first two letters give abbreviation of the name of act-group, e.g. QU – questions, VR – voluntary responses; the third letter is used only for AP acts – the first (F) or second (S) part of an AP act; 2) full name of the act, for example, QUF: WH (wh-question), QUS: GIVING INFORMATION, VR: CONTINUER. The act names are originally in Estonian.

[3] http://math.ut.ee/~treumuth/

In calls to travel agencies and directory inquiries, a customer wants to get information (and e.g. not to book a trip). When calling an outpatients' office or ordering a taxi, a customer expects an action by the operator in most cases (booking a reception time with a doctor, sending a taxi). Still, performing the action is accompanied with giving information (e.g. *yes, a taxi will come*).

In the following we will investigate how a customer achieves his goal, and how a collaborative operator assists him.

A typical call starts with a ritual part (greetings, identification, Schegloff, 1986). After that, a customer formulates a task starting the main part of the dialogue. During the main part, a task is solved in collaboration with an operator. A dialogue ends with a ritual part – thanking, leave-taking.

3 Customers' Goals

The main part of a dialogue begins with setting up of a goal by a customer.

3.1 What do customers ask

In our dialogues, a customer's goal is either 1) to get information (e.g. a phone number, address, etc.) or 2) to trigger an action by the operator (e.g. to send a taxi). In the latter case, the operator always informs the customer that either the action is performed or she is unable to perform it. Therefore, doing an action is accompanied with giving information.

In calls to *travel agencies* and *directory inquiries*, only information is asked for (phone numbers, bus schedules, opening hours of institutions, how to travel to a certain country, etc). There are no dialogues in our sub-corpus where a customer calling a travel agency books a trip.

Calling an *outpatients' office*, customers typically have a goal to book reception time with a doctor (21 dialogues), they seldom request information (about a certain patient, abatements, booking, following therapy – 5 dialogues in our data). Calling a *taxi company*, customers mostly want to order a taxi, i.e. they request an action (20 dialogues out of 22).

In majority of dialogues, customers achieve the goal. In directory inquiries, there are only two cases when a customer does not get the asked information (which is missing in a data base).

Calling an outpatients' office, a customer does not get information in one case because he is unable to describe the requested exploration. Booking a reception time succeeds in all cases.

Ordering a taxi succeeds in 18 cases out of 20. The 2 reasons of failure are that the taxi company does not have the requested mini-bus (one case), and a customer disclaims himself (one case).

In travel agency dialogues, the situation is different. A customer gets the requested information only in 12 dialogues out of 36. The typical reason of failure is that shared knowledge is missing – a customer does not have previous knowledge about the fields of activity of the agency (e.g. he asks how to travel to England but the agency offers only trips inside Estonia). In three dialogues, there are no more places available for the requested trip.

3.2 How do customers set up their goals

Customers use directives or questions in order to set up a goal.

In our typology, we make a difference between directives and questions (Gerassimenko et al., 2004). Questions have special explicit formal features in Estonian – interrogatives, intonation, specific word order. Other requests for information and directive-actions in sense of DAMSL are considered as directives (Ex 1)[4]:

(1)

```
.hh olen uvitatud reisidest
Skandi`naaviamaadesse=h. DIF: REQUEST
```

I'm interested in trips to Scandinavian countries

In *directory inquiries*, a customer typically asks one question or makes one request in order to set up his goal. In calls to *outpatient offices*, similarly one dialogue act is sufficient. If a customer expects information then he uses a question. If he expects an action of the operator then a directive is used. Ordering a *taxi*, a customer always uses a directive.

Calling a *travel agency*, customers use one dialogue act for setting up the initial goal in 22 dialogues (out of 36), and two acts (utterances) in one turn in 5 cases (mostly a question or a request together with specifying information). In the remaining 9 cases, a response of the operator (continuer or acknowledgement) follows to the customer's request which signals that the operator is waiting for adjustment of the initial request. After that, the

[4] Transcription of conversation analysis is used in examples, cf. http://math.ut.ee/~koit/Dialoog/EDiC.html and (Gerassimenko et al. 2004).

customer asks a question or adds specifying information to his request. This can be considered as a collaborative behavior because information comes to the partner step by step which makes understanding it easier (Ex 2, A – customer, B – operator):

(2)
A: .hh e sooviks: sõita Tallinnast `Münhenisse lennukiga. DIF: REQUEST
I'd like to travel from Tallinn to Munich by plain
B: jaa? VR: NEUTRAL CONTINUER
yes?
A: ee `üliõpilasele kui=palju `maksab. QUF: WH
how much does it cost for a student?

4 Subdialogues

The simplest structure of the main part of a dialogue is as follows:

A: request/question
B: (action +) giving information/missing information

This structure is preferred in directory inquiries but impossible in calls to outpatients' offices where booking a reception time is expected. In this case, some personal data are needed, and it would be non-collaborative if a patient gave all the data in his/her first request (cf. Gricean maxim of quantity).

There are 14 directory inquiries (out of 60) with such simple structure. In additional 17 inquiries, the operator initiates an information-sharing subdialogue after which she is able to give the requested information or to tell that information is missing in the data base. In the remaining directory inquiries, there are more subdialogues.

Only one ordering of a taxi has the simplest structure. There are no calls to travel agencies with such simple structure. Thus, there are few dialogues without sub-dialogues.

Therefore, a typical collaborative task-oriented dialogue includes sub-dialogues. A sub-dialogue is a rule, not an exception in conversation, they express collaboration (Lochbaum, 1998).

4.1 Information-sharing

Information-sharing is mostly initiated by the operator after a customer's first request or question. The purpose of it is to get additional information which is needed for answering. In a previous work (Hennoste et al., 2005), information-sharing subdialogues were studied in Estonian directory inquiries. It is typical that such a sub-dialogue consists of one question (offering an answer, yes/no or alternative question in most cases) followed by the answer or, more rarely, of one directive (offer) followed by agreeing (Ex 3, a subdialogue is marked with -->).

(3)
A: .hh `oskate te ehk `öelda Tartus:=e mõnda telefoni`numbrit `kus `tegeldaks vanurite `abistamisega, aga et see=ei=oleks nagu `piirkonna: (.) mingi number=aga (.) `üldine, £ QUF: OPEN YES/NO
could you give me a phone number in Tartu for help to older persons, not a district one but a general number
(1.5)
--> B: tändab aga siis ma pakuks teile äkki `linnavalitsuse sotsiaalabi `osakonna DIF: OFFER | ACF: ADJUSTING CONDITIONS OF ANSWER
well then I can propose the social wellfare department of the municipality to you
--> A: £ .hh ee jah, nähtavasti `küll=h. £ DIS: AGREEMENT | ACS: ADJUSTING CONDITIONS OF ANSWER (4.0)
yes obviously yes

The adjusting conditions of B's answer are either obtaining details for the information retrieval or for the action (e.g. if A wants to book a reception time with a doctor then his personal data are needed), or to offer choices to A (e.g. registration office or information desk of an institution), or to make a choice by the information operator and ask an agreement of A (Ex 3).

In directory inquiries, information-sharing will specify an institution (its name, location, structural unit, fields of activity) or will expect a choice/approval of a phone number.

If a customer who is calling an outpatients' office needs information about a patient (another person) then an operator always asks the patient's name, department of the hospital, time of the operation, etc before giving information. If a customer needs to book a reception time then the operator asks his name, ID code, has he visited the doctor previously, which type the visit is (regular, or for a deficiency certificate). The task is not solved until the operator has got all the needed data. Therefore, booking a reception time is different from a directory inquiry – the operator offers a

time before information-sharing but the patient's agreement does not mean that the goal is achieved (Ex 4).

(4)

```
B: .hh siis on kakskümend=kuus
ap'rill kell 'kuusteist kolm'kümend.
DIF: OFFER
```

April twenty six at 4.30 p.m.

```
A: jah, sobib 'küll. | DIS: AGREEMENT
```

yes, it's OK

```
--> B: ja kuidas lapse 'nimi on. QUF:
WH | ACF: ADJUSTING CONDITIONS OF
ANSWER |
```

and what's the name of the child?

In calls for a taxi, the customer's name, the flat number, and/or the phone number are asked by the operator if a customer orders a taxi to a block of flats with several entrances (the taxi operator is able to determine the house type on the basis of its address). After that, she confirms that a taxi will come. Therefore, sending a taxi is similar to booking a reception time at an outpatients' office – the task is solved only after the customer's data have been obtained.

The type of information needed by an operator determines the type of the dialogue act which initiates an information-sharing sub-dialogue. In calls to travel agencies, outpatients' offices or for a taxi, the operator typically asks wh-questions. Checking questions, yes-no questions and offers are the next more frequent dialogue acts. In calls to travel agencies, the operator typically requests the time and duration of the requested trip, the names and ages of travellers (Ex 5).

(5)

```
B: lennukiga? VR: NEUTRAL
ACKNOWLEDGEMENT
```

by plane?

```
--> kui=vana te ´olete.   QUF: WH |
ACS: ADJUSTING CONDITIONS OF ANSWER
```

how old are you?

```
--> A: mm (.) kakskümend=´üks. QUS:
GIVING INFORMATION | ACS: ADJUSTING
CONDITIONS OF ANSWER
```

um twenty one

```
--> B: olete ´üliõpilane. | QUF:
OFFERING ANSWER | ACS: ADJUSTING
CONDITIONS OF ANSWER
```

are you a student?

```
--> A: jah. QUS:YES | ACS: ADJUSTING
CONDITIONS OF ANSWER
```

yes

The first part of an AP used by B in starting of a sub-dialogue determines the possible second parts which can be used by A. In our dialogues, A's agreement/*yes* mostly follows B's offer/yes-no question (80%). This means that B correctly recognized A's (sub)goal.

Information-sharing sub-dialogues typically consist of one AP in directory inquiries and ordering a taxi (an operator asks a question and a customer answers). The sub-dialogues are longer in calls to travel agencies and to outpatients' offices because more adjustments are needed here (personal data, different details of a trip, etc). Table 2 gives an overview of adjustments in different types of dialogues.

Table 2. Information-sharing sub-dialogues

Dialogue type	**Number of adjustments**	**Typical information shared**
Travel agency	73	time, duration of a trip, personal data of travelers
Directory inquiries	58	name, location, fields of activity of an institution, choices of phone numbers
Outpatients' offices	70	reception time, personal data of a patient
Taxi	18	customer's name, flat number
Total	**214**	

The main aim of an information-sharing sub-dialogue initiated by an operator is to specify a customer's goal and to collect information for answering.

4.2 Clarification

Clarification is untypical in directory inquiries – a customer initiates a clarification sub-dialogue only in 10 cases. Adjustments (mostly expressed by wh-questions) are related to the location of the institution which phone number was received, the fields of its activity, how to call the number, and presence of other phone numbers.

In calls to outpatients' offices, there are 7 clarifications: what weekday is it, how long time a consultation lasts, is it free of charge (wh-questions, alternative or yes/no questions are used).

When ordering a taxi, a customer initiates a clarification in 9 cases, typically asking how long it takes to a taxi to arrive (by a wh-question), Ex 6.

(6)
B: ja `tuleb teile auto. DIS: OTHER
and a taxi will come to you
(.)
--> A: kui `kiiresti ta [jõuab.]
QUF: WH
how quickly it will arrive
--> B: [.hh] `saadan teile `Anne`linnast auto. QUS: GIVING INFORMATION
I'll send a car from Anne district to you
(0.5)
A: ahah? VR: NEUTRAL CHANGE OF STATE
I see
aitäh. RIF: THANKING
thanks

In calls to travel agencies, there are 39 clarifications – much more than in other dialogue types. It is understandable because there are many details of trips which are needed to be specified. Customers ask for the price, duration of a trip, is a visa and/or insurance needed, are they included into the price, are there abatements, are there another possibilities to travel, etc (Ex 7). Table 3 gives an overview of adjustments initiated by customers. The aim of a clarification initiated by a customer is to specify the answer received. A customer's initial goal is achieved but he is adjusting some more details.

Table 3. Clarification sub-dialogues

Dialogue type	**Number of adjustments**	**Typical information clarified by customer**
Travel agency	39	price, accommodation, visa
Directory inquiries	10	location of an institution, presence of other phone numbers
Outpatients' offices	7	duration of a consultation, which weekday
Taxi	9	time to wait
Total	**65**	

(7)
B: hh < siis jääb vist > (0.5) kell ´kaheksa läheb tegelikult ´välja (.) ee katama´raan, (.) sõidab ´tund nelikend=´viis. QUS: GIVING INFORMATION
a catamaran departs at 8 o'clock, the travel time is one hour forthy five minutes
A: ahah, VR: NEUTRAL CHANGE OF STATE
I see
sellega isegi ´peaaegu ´jõuab
AI: INFERENCE
I will almost manage
--> ja see on sis ´esimene laev=ve.
QUE: OPEN YES-NO
and is this the first boat?

4.3 Repair

We differentiate three types of repair initiations. The first two types are *checking* and *non-understanding:* the hearer initiates a repair and the partner carries it out. Both of these initiations indicate a perception problem by the hearer: non-understanding expects the partner to repeat, explain and/or specify the problematic part of his turn, and checking clarifies the problematic part thus expecting the partner either to confirm or to correct this repetition (Ex 8, a sub-sub-dialogue, and Ex 9). The third type is *reformulation* where the hearer initiates a repair and suggests her own interpretation of the problematic item. The partner may agree with or reject this interpretation (Ex 10). Thus the hearer is not correcting a mistake here but indicating an understanding problem.

(8)
A: sooviks taksot `Puurmanni `viis-teist. DIF: REQUEST
(0.5)
a taxi to Puurmanni fifteen please
--> B: ja `kelle `nimele. QUF: WH | ACF: ADJUSTIBG CONDITIONS OF ANSWER
and what's the name?
--> A: Ülle? QUS: GIVING INFORMATION | ACS: ADJUSTIBG CONDITIONS OF ANSWER
Ülle
(.)
----> B: `Ülle `nimele. QUF: OFFERING ANSWER | RPF: CHECKING
Ülle is the name
----> A: jah. QUS : YES | RPS: REPAIR
yes

(9)
B: 0.5) ´lennujaama vahe on ´ka kuhu te soovite. QUF: OPEN YES-NO | ACF: ADJUSTING CONDITIONS OF ANSWER (.)
is there a difference between airports you want to arrive to?
--> A: mis QUF: WH | RPF: NON-UNDERSTANDING
sorry?
--> B: et kas on ´lennujaama vahe ka kas ´Kätvik ((Gatwick)) või (.) [ei ole] QUF: OPEN YES-NO | QUS: GIVING INFORMATION | RPS: REPAIR
is there a difference between airports – Gatwick or not?

(10)
A: järgmine `teisipäev. QUS: GIVING INFORMATION | ACS: ADJUSTING CONDITIONS OF ANSWER
next Tuesday
(1.0) ää `kaks üliõpilast.
AI: SPECIFICATION
um two students
(2.0)
--> B: * kuupäev=on * (1.0) kakskend= `kolm jah. QUF: OFFERING ANSWER | RPF: REFORMULATION
the date is twenty third yes
--> A: jah. QUS: YES | RPS: PERFORMING
yes

The repairing sub-dialogues are initiated in certain limited cases, e.g. with regard to information that must be exact (prices, concessions, e-mail addresses, actions that will be carried out next). The problems that cause correction can in principle be located in an arbitrary past turn. In our sub-corpus, repairs are initiated with regard to the immediately preceding turn in 90% of cases. Table 4 gives an overview of repair initiations in our corpus. The most frequent repair initiation is checking. As one can expect, calls to travel agencies include the most number of repairs. Calls to travel agencies are different from other types of dialogues – reformulations are used almost only here, both by customers and operators, very frequently. The reason is that there are many details of trips which have to be clarified in order to understand them correctly.

Table 4. Number of repair initiations by customer (A) and operator (B)

Dialogue type	**Checking**		**Non-understanding**		**Reformulation**		**Total**
	A	**B**	**A**	**B**	**A**	**B**	
Travel agencies	8	16	5	3	19	12	**63**
Directory inquiries	10	11	3	2	2	6	**34**
Outpatients' offices	10	13	3	4	-	3	**33**
Ordering a taxi	1	12	-	10	-	3	**26**
Total	**29**	**52**	**11**	**19**	**21**	**24**	**156**

The aim of repairs is to solve communication problems and this way to work for solving the initial task, for achieving a communicative goal.

5 How to Model It?

Utterance	**Dialogue act**	**Goal stack**
A: (.) ee ma=oleks uvitatud informatsioonist kuidas: reisida ´Inglismaale. I'm interested in how to travel to England	QUF: WH	
B: jaa? yes	VR: NEUTRAL CONTINUER	travel to England
A: et: (.) ilmselt kas ´lennukiga: lennukipileti: (1.2) või=või obviously by plane or or	AI: SPECIFICATION |	
B: lennukiga? by plane	VR: NEUTRAL ACKNOWLEDGEMENT	travel to England by plane ~~travel to England~~
--> kui=vana te ´olete. how old are you	QUF: WH | ACF: ADJUSTING CONDITIONS OF ANSWER	age of the traveler travel to England by plane
--> A: mm (.) kakskümend=´üks. um twenty one	QUS: GIVING INFORMATION | ACS: ADJUSTING CONDITIONS OF ANSWER	
--> B: olete ´üliõpilane. are you a student	QUE: OFFERING ANSWER | ACF: ADJUSTING CONDITIONS OF ANSWER	status of the traveler ~~age of the traveler~~ travel to England by plane
--> A: jah. yes	QUS: YES | ACS: ADJUSTING CONDITIONS OF ANSWER	~~status of the traveler~~ travel to England by plane

Figure 2. Goal stack (Example 5)

A stack is an appropriate data structure to describe the setting up and abandoning of goals, shared between a customer (A) and the DS (agent, B). A's first question/request sets up the main goal which is put at the bottom of the stack (Fig. 2). The following information-sharing questions set up new goals which go into the stack step by step. To achieve the main goal, all the goals in the stack that are located higher than the main goal must be achieved and removed. If the stack is empty then all the goals have been achieved (Jokinen 1996).

To start a repair after A's request, DS puts a goal into the stack only after the repair is performed. Similarly, if A starts a repair after getting an answer then the goal remains in the stack until the communication problem is solved. Information-sharing is " forward-looking", i.e. advances a theme, while repair is " backward-looking", i.e. solves a problem in the previous text.

6 Conclusion and Future Work

Estonian institutional calls were analysed with the further aim to develop a DS. A customer's first request or question sets up a goal which will be achieved in collaboration with an operator. Sub-dialogues are initiated in order to set up and achieve sub-goals. Information-sharing is a transfer of knowledge from one partner to another in order to achieve a common goal in a collaborative dialogue. Clarification is initiated by a customer after receiving an answer if he needs to adjust some details of the answer. Repair can be used for solving communication problems by both participants, regarding both a question (request) or an answer (grant). A typical repair is reformulation in calls to travel agencies and checking of a phone number in other types of dialogues.

The structure of a dialogue depends on its type. Calls for a taxi have the simplest structure while calls to travel agencies include the most number of sub-dialogues of various kinds. In any case, sub-dialogues express collaboration of both participants who are working for achieving of a common goal.

A simple DS is implemented which gives information about flights leaving from the Tallinn Airport[5]. Our future work concerns implementation of the stack structure in the DS.

[5] http://math.ut.ee/~treumuth

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