

Designing useful conversational interfaces for information retrieval in career decision-making support

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Abstract. The proposal is an interdisciplinary problem-focused study to explore the usefulness of conversational information retrieval (CIR) in a complex domain. A research-through-design methodology will be used to identify the informational, practical, affective, and ethical requirements for a CIR system in the specific context of Career Education, Information, Advice & Guidance (CEIAG) services for young people in Scotland. Later phases of the research will use these criteria to identify appropriate techniques in the literature, and design and evaluate artefacts intended to meet these. This research will use an interdisciplinary approach to further understanding on the use and limitations of dialogue systems as intermediaries for information retrieval where there are a wide range of possible information tasks and specific users' needs may be ambiguous.

Keywords Conversational Information Retrieval, Applied NLP, Research-through-Design, Social Impact, Evaluation, Ethics

1 Introduction

This project explores the role of text-based dialogue systems to support young people with career decision-making, in collaboration with Skills Development Scotland (SDS), Scotland's national Career Education, Information, Advice and Guidance (CEIAG) service. A two phase research-through-design (RtD) methodology will be used: exploration of the problem space with CEIAG experts and users to delineate the requirements for CIR in this domain, then identification and validation of appropriate approaches for the design and evaluation of a system that meets these requirements. This report provides an overview of the first phase of the research, including CEIAG-specific issues; relevant literature identified; research questions; and the methodology. The report concludes with a brief discussion of potential directions for the second phase.

CEIAG raises challenges for CIR. SDS's interventions include a range of activities and resources, that aim to support young people to effectively explore and integrate career-related information into their career decision-making processes [1, 2]. Diverse information is

of relevance to career decisions, including information about personal preferences and skills, local job vacancies, training and qualification requirements, or macro-level labor market trends [3, 4]. SDS policies prioritize person-centered, social justice informed approach [5]. Therefore, their interventions aim to empower people to manage their own career decisions throughout their lives, in contrast with traditional interventions that seek to ‘match’ individuals to occupations [6, 7]. As such, the goal of CIR in this domain is to provide automated, interactive access to information, without inadvertently enacting a ‘matching’ paradigm.

Conversations with CEIAG practitioners may involve the discussion of complex, sensitive and emotive topics [8]. Therefore, CIR introduces an element of ethical risk, when compared to a static search-term based information retrieval approach. CEIAG has a significant impact on economic and social outcomes for both individuals and society, hence CEIAG services being a public policy issue in many countries, including Scotland [9–12]. Therefore, there is a strong ethical imperative to ensure that the design of CIR systems for this domain are aligned with the policies and professional standards of CEIAG services.

2 Related work

Concerns regarding the use of automated systems have also prompted public policy response. Of relevance to this research are publications by the Scottish Government [13], the UK government [14], the OECD [15] and UNICEF’s Policy guidance on AI for children [16]. Although these documents are currently advisory, a system designed for use by a public sector organization will be expected to adhere to these emerging standards. The core principles across all documents can be mapped to Dignum’s [17] ‘accountability, responsibility and transparency’ [17–22]. In addition to general concerns regarding autonomous systems, conversational interfaces can enact representational and allocational harms to individuals and groups when the impacts of existing social hegemonies are not considered during system design [23–25]. Given the priorities of CEIAG, a foundational aim of this research is ensuring that these risks are adequately mitigated. This will extend beyond technical solution to include consideration of the role that people and processes may serve to mitigate or intensify any potential negative consequences [26].

CEIAG services already have a wide range of established methods and technologies to support the dissemination of career-related information [3, 27–30], and most intended users will be familiar with digital information consumption, including for careers support through SDS’s existing digital services [31]. Therefore, for CIR to be of genuine benefit, a positive user experience (UX), that meets users’ ‘physical, cognitive and emotional...needs and expectations’ [32] is required. As such, evaluation methods for applied CIR should consider of both the practical, task-orientated outcomes, and the social aspects of the interaction [33]. Several evaluation frameworks have been developed to address this issue [34–38], however, these are largely focused on customer service style tasks, where the problem and solution

are more clearly bounded than a CEIAG intervention. Traditional approaches to designing UX do not readily transfer to conversational interfaces [33-34]. Evaluation methods for dialogue systems largely focus on utterance level measures rather than users' interaction with a system. These issues informed Moore & Arar's [39] proposed adoption of *recipient design*, *minimization* and *repair* from conversational analysis in the design and evaluation of conversational user interfaces. Recipient design strategies observed between human interlocutors aim to demonstrate their alignment with their conversational partner through both mirroring conversation style and lexicon and consideration of the recipients' understanding of the topic under discussion [39]. In addition to ensuring that the affective needs of users are met, this also serves the aim of minimization, the principle that the minimum number of utterances should be used to meet the conversational aims. Repair relates to utterances that are designed to correct issues arising from failures of the former strategies [39]. These conversational analysis structures have been identified in task-based human-computer dialogues, although the specific strategies deployed differ from human-human conversations [40, 41].

CIR research frequently focuses on a conversational, as opposed to utterance level, approach to the design and evaluation of systems [42, 43], modelled on human information seeking conversation [44]. Several interaction-focused CIR studies focus on approaches that are analogous to the conversational analysis concepts outlined above. The use of clarifying questions in mixed initiative CIR [45] and the elicitation of direct feedback on possible results to refine future responses [46] are examples of repair strategies. Minimization raises issues for CEIAG, as there is a need to balance the risk of cognitive overload with the requirement to avoid 'matching' users with too narrow a range of information. Vakulenko et al's [47] 'conversational browsing' approach has potential, as it addresses situations where the information needs of users are ambiguous and their knowledge of the information domain may be low. Document meta-information [48] may also have a role in avoiding information overload for users exploring across a dataset, while allowing users to focus on facets that are of most relevance to them.

The stylistic elements of recipient design are analogous to current research addressing problems of 'alignment', where the aim is to adjust system utterances to reflect the users' style [49] and lexicon [41]. However, issues of assessing and adjusting system responses based on users' knowledge in CEIAG are complex, given the breadth of both information needs and sources of information relevant to career decision-making.

3 Proposed research approach

SDS's services for young people present a well-defined use-case in which to explore the grounded development of CIR for ambiguous and complex information needs, while operating in accordance with defined ethical standards. Given the range and potential impact of CIR tasks for CEIAG discussed in Section 2, it is necessary to clearly delineate the goals

and boundaries of the system. This leads to the following research questions to be addressed in the first phase of the research: RQ 1. In the context of SDS's CEIAG service, which career information tasks could CIR effectively meet users' practical and affective information needs? RQ 2. How can the principles of accountability, responsibility and transparency be assured in a CIR system in the CEIAG domain?

These will be addressed using a Research through Design (RtD) methodology. RtD is an approach to conducting scholarly research that leverages design practice to generate new knowledge [50]. Reflexivity and evaluation of the process of developing a solution, engenders deeper understanding of the problem space and the consideration of the potential impacts of proposed solutions [51]. In line with SDS [Click or tap here to enter text.](#) and Scottish Government [1, 52] approaches to service design, the first stage of the research will focus on developing a detailed, understanding of the problems that CIR could address within CEIAG, based on the knowledge and experience of domain experts and system users. The outcome of this phase will be a delineation of the practical, interactional, and ethical requirements that a system would have to meet in order to be a useful addition to existing sources of support.

A Delphi study [53] is a method for canvassing a group of experts for their views on emerging technologies [54], and therefore, has been identified as suitable for addressing the RQs above. Three rounds of surveys are being conducted with CEIAG experts from across policy, service design and practice domains. The questions focus on identifying consensus on specific CIR tasks that could be usefully addressed in this domain, and appropriate information sources to incorporate. Feedback on the potential impacts of a CIR system on CEIAG professional standards and ethics, and mitigation strategies, will also be canvassed. This approach aims to leverage the knowledge and experience of domain experts to clearly map the problem space. These insights will be augmented through a Wizard-of-Oz study [55–57] with young people. This method involves a human researcher communicating with participants in a manner that implies that they are interacting with an automated agent. The study will provide evidence about young people's interaction preferences, through both their responses to direct questions and analysis of the transcripts. The dialogues will incorporate a range of conversational UX strategies [39, 58], in order to observe users' responses.

4 Conclusion and Future Work

By collecting data from both CEIAG experts and young people, the first phase of the research aims to develop a fully rounded view of the requirements for a dialogue system to be useful as an CEIAG information intermediary. This will inform the subsequent phase of the research, which will focus on identifying suitable CIR approaches for the design and evaluation of a system based on these requirements. In the course of designing and validating artefacts to resolve an established, complex, real-world CIR problem, the research aims to further current understanding of CIR in practice.

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